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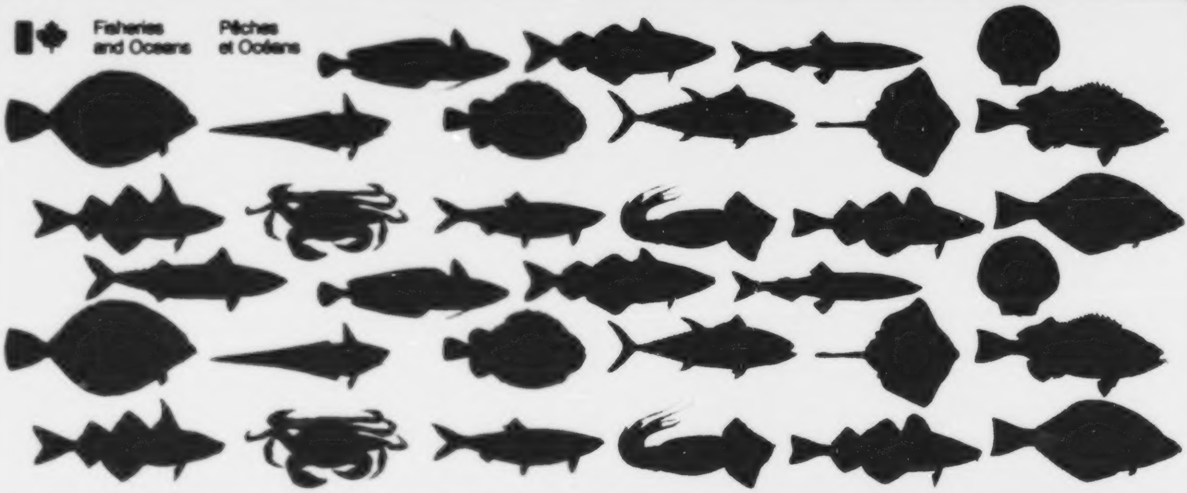
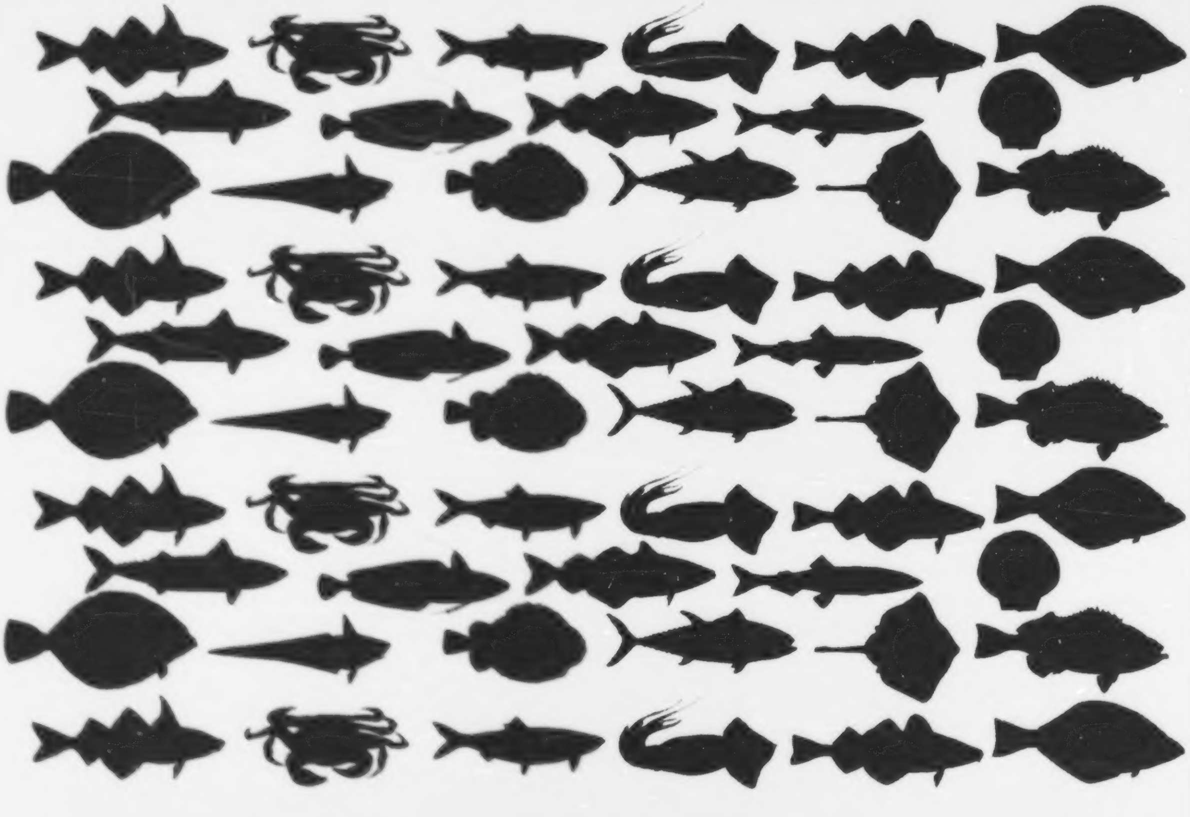


Resource Prospects for Canada's Atlantic Fisheries

1985-1990



Canada

85-6458/

RESOURCE PROSPECTS
for
Canada's Atlantic Fisheries
1985-1990

June 1985

Published by:

Communications Directorate
Fisheries and Oceans
Ottawa, Ontario
K1A 0E6

DFO/2188

Minister of Supply & Services Canada 1985

Cat. No. Fs 33-1985/3E

ISBN 0-662-14118-0

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INTRODUCTION

Severe resource declines, falling prices and rapidly escalating costs of catching and processing combined in 1974 to threaten the survival of the Canadian Atlantic groundfish industry. The decision by the Government of Canada to extend fisheries jurisdiction to 200 miles was given emphasis by a fisheries resource crisis off the Canadian Atlantic coast. A major objective of the 200-mile management regime is to rebuild the resource so as to provide increased catches and catch rates for Canadian fishermen.

To provide a basis for planning and development of Canada's east coast fisheries, Fisheries and Oceans scientists prepared in 1977 a comprehensive forecast of resource prospects for Atlantic coast fish* stocks to the mid-1980's. This document represents the revision for the 1985 fishing year.

These projections, which are given in the form of a projected Total Allowable Catch (TAC) for each stock, should be viewed only as a general guide to likely events. While 1985 predictions are based largely on formal calculations, and actual events should not differ widely from those predicted, projections of stock status in later years are to a considerable extent best guesses, based on inadequate knowledge. The precision of these estimates varies greatly depending on whether they are based on known mortality rates and predicted levels of recruitment, or on generalized production models relating overall landings and fishing effort, or on "best estimates from the scientists and managers concerned". Accurate predictions of the strength of year-classes expected to recruit to the various stocks are impossible except for one or two years in advance; these "recruitment" predictions are, however, critical to any projections of catch and catch rates. Despite these uncertainties, an attempt has been made to provide long term resource projections by major species and species groupings in order to provide a framework for fisheries development planning, although it must be borne in mind that the actual TAC for a particular stock in any year may differ widely from those projected here. Indeed forecasts will change from year to year as our information increases and as we take into account the strengths of the succeeding year-classes which are, by the very definition of "average", likely to be different from the average value assumed in previous projections. The significant changes between the forecasts contained in the previous editions of this document are given later in this introduction and illustrate the degree of variability inherent in the projections.

---

*Including shellfish, marine mammals and marine plants.

To develop these resource projections, certain assumptions have been made about management objectives in the 1980's. There has been a major change in fisheries management approach within the past few years, particularly the abandonment of the maximum sustainable yield (MSY) concept as the basis for establishing levels of harvest. The objective of MSY managment was to obtain the maximum sustainable (average) physical yield from the resource, i.e., to get every available ounce of sustainable production from the fish stocks. This approach had serious drawbacks, not the least of which was the cost of getting that production. Pursuit of MSY almost invariably meant low catch rates, relatively small fish, relatively low stock sizes and great variability in supply. Because of inadequacies in the data base, and lack of adherence to TACs, there was also a tendency for the target to be exceeded, resulting in stock decline. Indeed, catches, particularly in the years prior to the establishment of TACs, often exceeded the MSY and accelerated the introduction of management measures such as TACs.

Attention has recently been focussed on an alternative resource management concept called "optimum sustainable yield" or OSY. There will be no universal definition for this concept, since inherent in the phrase are economic and social as well as biological considerations. Thus, optimum sustainable yield will vary among species, over time, and among areas for a given species. Fisheries scientists no longer produce advice based on a lowest common denominator concept such as MSY but give a range of alternative predictions corresponding to a range of possible management strategies. For the moment, a somewhat arbitrary reference point which scientists call "$F_{0.1}$" is in wide use when data on the age structure of the population is available and a 2/3 F_{msy} reference point is used when catch and effort data only is available. In general terms, this corresponds to a level of fishing beyond which increases in total catch relative to increases in fishing effort are marginal. These reference points need not be adopted in the long term for all fish stocks within the Canadian 200-mile zone. Fish stocks can be managed to give stable average catch rates over the long term at various levels within the biological limits of the species, taking into account fishing costs and market prices. Within biological limits, the supply can be managed up or down in response to social and economic factors including market prospects.

Since 1977, most of the major fish stocks within the Canadian Atlantic zone have been managed at the level of fishing corresponding to $F_{0.1}$ or 2/3 F_{msy} in order to permit stock rebuilding; the projections assume that this level will be maintained through the 1980's. This strategy can be modified, as for instance has been the case for the northeast Newfoundland-

Labrador cod stock (2J+3KL)[1], where fishing was set at a level less than $F_{0.1}$ in order to permit more rapid stock rebuilding. A change in management strategy for any stock would, of course, alter significantly the projections given here. These projections also assume maintenance of recent average recruitment into the future and will require revision should there be significant departures from the recent average. They further assume that TACs are in fact taken and neither exceeded nor under-utilized.

The catch rate projections, where provided, are based upon a relative index of stock size (in weight) with a 1984 base index of 1.00. They are independent of vessel size and gear category and represent percentage increases or decreases compared with catch rate experienced by any particular vessel type in 1984. In general, if no catch rates are given, the rate is likely not to change, or the estimates of future catch levels are not based on a sufficiently adequate base to justify such projections.

It should also be noted that no attempt has been made to partition stocks straddling the 200-mile boundary into portions inside and outside 200-miles; instead, the projections have been made for these stocks as a whole. Flemish Cap stocks, which lie entirely outside 200-miles, have also been included. Although projections have also been made for Georges Bank fish stocks, future yields from this area will be dependent upon the management regime implemented over the next few years as a result of the boundary settlement.

It may be useful in considering forecasts of total catches to note that these may seem surprisingly low in comparison with catches seen briefly in the past. These earlier peak catches were, however, obtained by the sudden imposition of very high effort levels upon stocks that had not been fished to any great extent in the past. The abundance of these stocks was thus, very high, with little more than natural mortality and environmental factors controlling the numbers. The imposition of fishing effort leads to reduction in abundance but it takes several years for the numbers to come into equilibrium with any change in the level of fishing effort. Indeed the recovery of catches envisaged in this document represents the recovery of the stock abundances to come into equilibrium with the reductions in fishing effort already imposed by restricting fishing to the "$F_{0.1}$" point.

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[1] Stocks are identified by statistical areas as illustrated in Figure 1.

CHANGES IN THE FORECASTS

Increased knowledge about the individual stocks and about the interrelationships between species will improve the accuracy of forecasts with time, and indeed there are at present, many stocks for which great improvements in the data base are necessary. One very important aspect of attempting projections is, however, likely to remain extremely difficult to improve and this is the forecasting of recruitment, i.e. the strength of new year-classes. In the earliest editions of this document, a number of stocks were projected to remain at existing levels since the recruitment, at least to the fishable component of the stock, had remained very low for several years and thus provided no basis for suggesting improvement in the future. Subsequently, however, new data indicated strong recruitment to some of these stocks, e.g. 4RS 3Pn cod and 4RST redfish. Changes in other forecasts reflect additional knowledge about the most recent year-classes, thus, for instance the 2J3KL cod stock has experienced several weak year-classes in a row, and since these year-classes will support the stock through the period of the projections, the forecast has been reduced.

The table below provides a summary of the major changes in the estimated 1985 TAC, as forecast in various years.

		Present Forecast	1981 Forecast	1980 Forecast	1979 Forecast
Cod	2J3KL	266	310	365	402
	3Ps	41	46	36	32
	4RS3Pn	100	95	75	75
	4T+Vn	77	66	65	33
	4VsW	55	60	66	7
Redfish	3LN	25	25	25	18
	3P	18	20	20	5
	4RST	50.6	32	20	11
	4VWX	30	30	30	23
Haddock	4VW	15	25	25	2
Witch	2J3KL	8	8	17	17
Greenland Halibut	2+3KL	75	55	35	30
Herring	4VWX	91	130	90	120

These changes serve to illustrate the uncertainties inherent in these forecasts and to emphasize that the forecasts cannot be considered as prediction, since they are projections based on present conditions and in many cases on inadequate knowledge.

They will, therefore, be subject to further changes in subsequent years. It should be noted, however, that these uncertainties apply to individual stocks so that increases in some stocks may be offset by decreases in other stocks of the same species.

SPECIES OVERVIEW

GROUNDFISH

Cod Total allowable catches in 1985 sum to 636,000 t[2],[3] compared with a peak catch of 1,187,000 t in 1968 from the northern area (Newfoundland-Labrador) and 263,000 t in 1970 from the southern area (Scotian Shelf and Gulf of St. Lawrence). Substantial reductions in stock abundance occurred throughout the Northwest Atlantic as a result of over-exploitation in the late 1960's and early 1970's. If cod stocks in general continue to be managed at a fishing mortality of $F_{0.1}$, TACs[3] of 664,000 t, 715,000 t and 751,000 t are projected for 1986, 1988 and 1990 respectively. Stock recovery is evident for the northeast Newfoundland-Labrador (2J+3KL), the two Gulf of St. Lawrence and eastern Scotian Shelf cod stocks.

Haddock Catches have recently been between 40,000 t and 50,000 t from two stocks on the Scotian Shelf (4VW and 4X) almost at a level of the sustained catches of about 50,000 t in the early 1960's. Stock levels in 4VW increased in the early 1980's, but catches from this stock are forecast to decrease to 12,000 t . Some slight increase in the 4X TAC is anticipated in the late 1980's, with an increase in catch rate, but these catches would be above the expected long-term average.

It should be noted that the Grand Banks haddock stock has never recovered from a combination of recruitment failure and over-exploitation in the early 1960's.

Redfish. This is an extremely slow-growing and long-lived species, first entering the fishery at ages 7-10;

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[2] t = metric (ton(s)

[3] Including cod caught in 4X, estimated at 25,000 t for 1985.

individuals aged 20 and over, comprise a significant part of catches from lightly-fished stocks. Thus, in order to rebuild a depleted stock, catches must be restricted to low levels for a considerable number of years.

Total catches of redfish from the Gulf of St. Lawrence and Scotian Shelf peaked at 170,000 t in 1973. Catches off Newfoundland-Labrador fluctuated between 63,000 and 136,000 t during the period 1964-73. TACs for all redfish stocks, (including the Gulf) add to 199,000 t for 1985. Overall, little change is anticipated in the different redfish stocks with the exception of 4RST where the incoming year-classes of the early 1970's will allow for increased yield to allow for catches to be increased to over 50,000 t for the next two years.

Flatfish Present estimates of yield at $F_{0.1}$ in the Newfoundland-Labrador area sum to 170,000 - 180,000 t. TACs for the area in 1985 total 172,000 t. The major change is that since 1983 an additional 20,000 t TAC has been annually allotted for Greenland halibut in 2GH.

On the Scotian Shelf, the current TAC is for plaice, witch and yellowtail stocks combined. The TAC is being maintained at 14,000 t which was first introduced in 1978 to aid in the rebuilding of the stocks. Previously, from 1974-77 the TAC was set at 28,000 t.

Catches of flatfish (plaice, witch, yellowtail and winter flounder) from the Gulf of St. Lawrence are projected to be approximately 13,500 t in 1985.

Pollock Pollock on the Scotian Shelf (4VWX) and off the New England coast (Subarea 5) are managed as one stock. In recent years, about 65 per cent of the catch has been taken from the Scotian Shelf. The 1977 and 1978 TACs were set at 30,000 t, and subsequently increased to 40,000 t in 1980, 54,000 t in 1981 and 55,000 t in 1982. Subsequently, the $F_{0.1}$ catch has been reduced to 53,000 t in 1985.

Roundnose Grenadier Nominal catches decreased from 75,000 t in 1971 to 15,400 t in 1977. The TAC was set at 35,000 t for 1978 and 1979, 30,000 t for 1980 and was reduced to 27,000 t for 1981 and 1982, and further to 11,000 t for 1983, 1984 and 1985, due to declining catch rates.

Argentine Most recent estimates of sustainable yield for the Scotian Shelf (4VWX) is 10,000 t.

Other Groundfish It is expected that about 20,000 t of other groundfish (species not currently subject to quota), e.g., white hake, wolffish, and skate, will be caught in Subareas 2 and 3 and 30,000 in the Gulf of St. Lawrence each year by 1990. Catches of similar unregulated stocks on the Scotian Shelf are expected to yield in the order of 50,000 annually by 1990.

GROUNDFISH SUMMARY

TACs for 1985 for the traditional major groundfish species* in Subareas 2, 3 and 4 (Labrador to Nova Scotia, including the Gulf of St. Lawrence) sum to 1,116,100 t, the Canadian share of which is 927,400 t. This compares with Canadian catches (of the same species) of 384,000 t in 1974 (the lowest in recent years), 437,000 t in 1976, 549,000 t in 1978, 675,000 t in 1980, and 807,000 t in 1984, the highest on record; the previous high being 614,000 t in 1966. These figures do not include approximately 25,000 - 30,000 t of miscellaneous unregulated groundfish caught by Canada.

The 188,700 t of such traditional groundfish species allocated to countries other than Canada in 1985, consist of 90,000 t of cod, 58,600 t of redfish, 23,000 t of flatfish, and an estimated 11,000 t of pollock (a transboundary stock shared with the U.S.A.). It should be borne in mind that these figures include cod, redfish and American plaice on the Flemish Cap (entirely beyond 200 miles), allocations of stocks straddling the 200 mile limit and allocations for France in the area of St. Pierre and Miquelon and in the Gulf, the latter under Treaty rights.

TACs of the major groundfish species traditionally fished by Canada are expected to increase from 1,116,100 t in 1985 to 1,147,500 t in 1986, 1,200,500 t in 1988, and 1,223,500 t in 1990.

When groundfish species (e.g., skate) not subject to regulation at present, but caught regularly by Canadians, and groundfish not normally fished by Canadians, such as silver hake and grenadier, are included the overall TACs are predicted to increase from 1,304,000 t in 1985 to 1,338,000 t in 1986, 1,359,000 t in 1988 and 1,414,000 t in 1990.

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* cod, redfish, haddock, pollock, American plaice, witch, Greenland halibut and yellowtail.

PELAGIC FISH

Herring Catches from individual stocks have fluctuated widely. Total catches exceeded 500,000 t in 1968-70, (mainly taken by Canada - peak catch 478,000 t in 1970), but declined to 229,000 t in 1976 (Canada 225,000 t). Recruitment to most herring stocks has been below average in recent years, thus, the overall TAC is forecast to decline into the future unless recruitment improves.

Mackerel While total Northwest Atlantic catches have exceeded 400,000 t in some years, the maximum catch off the Canadian coast was only 45,000 t. The analysis of available data indicates a succession of poor year-classes from 1975 to 1980. Preliminary estimates indicate that the 1981 year-class may be slightly above average. Catches in the order of 100,000 t over the next few years should not be harmful to the stock. Since this is a transboundary stock, the quantity to be harvested in the Canadian zone cannot be projected but probably will be at least 40 per cent of the TAC.

Capelin Offshore fisheries for the species began in 1972 with the catch reaching 367,000 t in 1975 from a TAC of 500,000 t. Subsequently, the recruitment to the stocks in SA 2 and 3 has been extremely poor and TACs tumbled to less than five per cent of this figure. Rebuilding of these stocks is difficult to predict since recruitment is highly variable. Furthermore, since cod, whale and seal stocks will be rebuilding during the next few years, the quantity of capelin surplus to the needs of major predators will decrease. Thus, capelin TAC levels are not expected to rebuild to the levels in the mid-1970's, and will not exceed 230,000 t. A modest improvement in recent recruitment to capelin stocks in 2+3 has resulted in increased TACs to 138,000 t in 1984 from the low of 21,000 t in 1980.

FINFISH SUMMARY

The overall finfish TAC is projected to increase between 1985 and 1990 from 1.52 to 1.56 million t. This compares with a 1981 Canadian catch of 932,000 t and a 1983 Canadian share of 995,000 t.

INVERTEBRATES

Lobsters The landings of 22,800 t in 1982, 5 per cent greater than 1981, continued the general upward trend of the late 1970's. Preliminary statistics for 1983 suggest the trend may continue upward, in most areas. The area where landings are most depressed below historical levels (southeast coast of Nova Scotia) has started to contribute to the upward trend. If size limits are increased to recommended levels, and general or selective reductions in effort are achieved, a reduction in yearly catch fluctuations may be expected, and a long term improvement in catches overall, as well as substantial improvements in those areas where catches are most depressed.

Scallops Georges Bank scallop landings per vessel continue to decline sharply with the depletion of the above average year-classes of the late 1970's. Future levels will depend upon recruitment levels and upon management measures which will be adopted on Georges Bank. Landings from the southwestern Scotian Shelf, have increased since 1979 as a result of several good year classes and increased effort.

Shrimps Landings in the Gulf have increased from 1,000 t in 1971 to 9,000 t in 1983 as the fishery developed. A shrimp fishery is also under development on the Labrador Shelf, but no long term forecast can yet be made. The 1983 catch in this area was 1,000 t. There is a large shrimp stock in the Greenland zone that spreads into Canadian waters. For the international fishery, a TAC of 29,500 t has been advised annually since 1979, with a Canadian share set at 5,000 t annually since 1981. Canadian catches have ranged between 1,700-4,000 t (1979-1983). During 1983, the Maritimes fleet exploited the Nova Scotian Shelf shrimp fishery which has a TAC of 5,800 t.

Crabs In Newfoundland, some areas near to shore (Bonavista Bay and Conception Bay) have been over-exploited resulting in reduced catch rates. The fishery is still expanding in the offshore areas. It is not possible to predict catches each year, but they are expected to be in the 8,000 t - 15,000 t range during the next decade.

The snow crab fishery in the southwestern Gulf of St. Lawrence started in 1966, catches have expanded rapidly to 7,600 t in 1969. Subsequently, landings fluctuated but increased further to 16,000 t in 1978. Since 1978, landings increased to a maximum of 28,000 t in 1982, but declined to 26,000 t in 1984.

The Cape Breton inshore stock of snow crab appears fully exploited. Landings are projected to level off at 1,400 t - 1,500 t per annum. Rock crabs, Jonah crabs and deep-sea red crabs are presently under-utilized.

Oysters Although landings still depend heavily on the production from Caraquet Bay, N.B., and Summerside Harbour, P.E.I., Cape Breton Island started to make a significant contribution in 1979. Annual landings have been 1,403 t, 1,322 t, and 1,486 t from 1981 to 1983 inclusive.

Squid Increased squid catches 1975-1978 were due to both increased abundance and increased fishing in response to foreign market demand. The inshore landings, primarily from Newfoundland, increased from 45,000 t in 1978 to 89,000 t in 1979, but decreased to 11,000 t in 1982. The offshore landings, primarily from the Scotian Shelf, increased from 52,000 t in 1978 to 71,000 t in 1979, but decreased to 2,000 t in 1982 and 417 t in 1983. At present, it is not possible to forecast stock abundance. TACs for 1980-85 of 150,000 t were determined as being an appropriate catch level based on an average year's abundance. Research is underway to develop predictive indices from annual pre-season recruit surveys.

Clams Soft-shell clams continue to represent the most significant component of 1984 clam landings, accounting for 3,000 t. Production over the next several years will stabilize at 2,500 t to 3,500 t annually.

Marine Plants *Chondrus crispus* (Irish moss), *Furcellaria lumbricalis* (wireweed), *Gigartina stellata* (Fundy moss), *Palmaria palmata* (dulse), *Ascophyllum nodosum* (rockweed), and *Laminaria longicruris* and *L. digitata* are harvested in the Maritime provinces. The total annual harvest approximates 38,000 wet t. The mean annual harvest of Chondrus for the past 7 years is 24,000 wet t; 17,000 wet t is dragraked in the southern Gulf and 7,000 wet t is handraked off southwestern Nova Scotia. Management schemes being implemented should increase the mean annual harvest. *Furcellaria* and *Chondrus* are harvested as a storm-tossed "mixture" off northeastern Prince Edward Island; dragraking, if introduced, would likely increase the annual harvest although its effects should be assessed. It is expected that the harvest of *Ascophyllum* will result in yields similar to those prior to 1979 and perhaps will reach 10,000 wet t. The potential of the *Laminaria* spp. resource is being assessed. The harvest has, however, declined by a factor of two since the early 1970's. Little is known about *Gigartina* and *Palmaria* harvesting and their resource base.

MARINE MAMMALS

Seals There is evidence of an increasing abundance of the harp seal population, the total allowable catch in 1984, in the area within Canadian jurisdiction, was, however, maintained at 186,000 animals. Of this amount, 11,000 was set aside for the catch in the Canadian Arctic and Northern Labrador, although catches were substantially lower than this, due to market conditions. A total of 151,000 was allocated to the regulated components of the Canadian seal hunt, while 24,000 was held in reserve.

Sub-allocations to the various components of the sealing industry within the Atlantic region are made to provide each component with fair access to the harvest. The allocation system establishes ceilings on allowable catches by each component, and has resulted in actual catches which until 1983 have, in total, been slightly below the annual quotas established since 1977. Catches in 1983 and 1984 were very significantly reduced due to market conditions. No large vessels participated in the 1984 hunt.

GEOGRAPHIC OVERVIEW

Gulf of St. Lawrence

Despite some increased in the TAC's of cod and redfish, overall, the groundfish resource situation in the Gulf offers no possibilities for a sustained increased effort. The level of groundfish effort in the Gulf has been increased slightly in the short term to harvest increases in the redfish stock. Pelagic species, such as mackerel have a potential for increased catches, offering possibilities for development. The major invertebrate species, however, appear to be fully exploited, although some increases in catches are possible for shrimp.

Scotian Shelf

Catches of groundfish on the Scotian Shelf which increased rapidly very recently as stocks rebuilt are projected to decrease slightly over the next few years. Thus, the Scotian Shelf does not offer opportunity for any increase in effort for traditional groundfish. Some reallocation of effort could, however, result from diversion into non-traditional species, e.g. squid, silver hake or argentine. Among pelagic species, there is still a potential for expansion of the Canadian mackerel fishery. The invertebrate resources of the Scotian Shelf do not offer any potential for expansion of effort, with the possible exception of deep sea red crab and shrimp.

Grand Banks-South Newfoundland

The groundfish fisheries may increase provided that conservation measures are respected, and provided that the bycatch in the cod fishery does not significantly impact upon the flatfish stocks. Redfish TACs, are not currently being fished fully, due to practical problems rather than problems with stock status. Among the pelagic species, herring are fully exploited. Although the capelin stocks are depressed at present, this species may provide a future opportunity for expansion of Canadian fisheries, provided that this resource can be harvested economically. Snow crab stocks are fully exploited in the southern zone of Newfoundland. Current exploitation rates exceed the target levels for the area.

Northern Newfoundland-Labrador

The dominant fishery in this area is on the northern cod stock. The TAC for this stock is expected to increase significantly (from 135,000 t in 1978 to approximately 336,000 t in 1990). Stock size is expected to attain levels that will greatly increase the availability to inshore fisheries. With the exception of capelin, other stocks in the area are likely to remain stable. The northern capelin is similar to that on the Grand Banks; there is potential for expansion of Canadian effort despite the presently depressed state of the stock. Invertebrate resources, especially shrimp, are attracting great attention, but the shrimp fishery is not likely to offer opportunities much beyond those experienced currently. Landings will mostly depend upon the economics of the industry.

Baffin Bay - Davis Strait

The resources of this area are not well known, particuarly in the western area, i.e. within the Canadian zone. The Greenland shrimp stock complex, with a TAC of 29,500 t for 1985, extends into the Canadian zone. Based on estimates that 17 per cent of the resource is in the Canadian zone, 5,000 t has been allocated to Canada. Some Greenland halibut and roundnose grenadier have been taken in Division 0B and Subarea 1.

STOCK BY STOCK FORECAST

GROUNDFISH

Cod: Northern Labrador (2GH)

A TAC of 20,000 t has been maintained since it was introduced in 1974. The 1973-75 year-classes are stronger than previous ones, a situation similar to that in the 2J3KL cod stock. It appears therefore, that cod in 2GH are related to the 2J3KL stock and the abundance in this area may well follow a similar pattern of increase as that projected for the latter stock. The projected long-term TAC, however, should at present, be considered as 20,000 t. Ice conditions are a major factor affecting catches from this area. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	20	20	20	20	20	20	20
Nominal Catch ('000 t)	2	4	5	14	2.3[a]		

[a] preliminary

Cod: Southern Labrador-Northern Grand Bank (2J+3KL)

In the past the management strategy was to maintain the fishing mortality rate at 0.16, below the $F_{0.1}$ level of 0.20, for the purpose of rebuilding the spawning stock biomass and to provide for a faster recovery of the inshore fishery. Since the spawning biomass in the 1983 assessment was projected to reach the range of the target spawning biomass established by ICNAF in 1978 (1.2-1.8 million tons) at the beginning of 1985, even by fishing at $F_{0.1}$, the TAC for 1984 was set at the $F_{0.1}$ level (266,000 t). In the 1984 assessment, the spawning biomass at the beginning of 1986 is still projected to be within the target spawning biomass range, although about 10% lower than that projected in the 1983 assessment for the beginning of 1985. This difference is mainly due to declining average weights-at-age in recent years. The 1978 year-class is about 50% larger than the long-term mean of 400 million fish while the 1979 and 1980 years class appears to be about equal to this mean. Recent catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	180	180	200	237	260	266	266
Nominal Catch ('000 t)	167	176	171	228	230[a]		

[a] Preliminary

The projected catch assumes that fishing mortality is maintained at $F_{0.1}=0.20$.

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	1785	1845	1963	2019	2090	2172	2263
Catch ('000 t)	266	266	290	295	305	318	336
Catch Rate Index	1.00	1.00	1.10	1.13	1.17	1.22	1.27

Cod: Flemish Cap (3M)

Using a general production model, the MSY for this stock has been estimated at 40,000 t and 2/3 F_{msy} at 34,000 t. The stock is in a depleted state and the age composition of the population is dominated by young fish. Calculated total mortality rates for recent years have been high relative to estimated natural mortality and $F_{0.1}$. Thus the stock can be expected to remain in a depressed state unless recruitment prospects significantly improve. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	40	13	12.8	12.4	12.4	12.9	12.97
Nominal Catch ('000 t) ('000 t)	30	11	14	13	10[a]		

[a] Preliminary

Cod: Southern Grand Bank (3NO)

In recent years the management strategy for this stock was to set a TAC of 26,000 t until the age 3+ annual mean biomass reached 200,000 t. The 1982 assessment indicated that this level would not be reached in 1983 and as such the TAC remained unchanged. Similarly, no change was recommended for the 1984 TAC because the 1983 assessment estimated that the target biomass would be reached in 1984 only if the most optimistic assumptions concerning recruitment were realized. The 1984 assessment, however, projected that the biomass in 1985 would be 226,000 t and, therefore, fishing at $F_{0.1}$ in 1985 would yield 33,000 t.

Recent nominal catches and TACS are as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	25	26	26	17[a]	17[a]	26	33
Nominal Catch ('000 t)	28	20	24	32	29[b]		

[a] Excludes expected catches by Spain
[b] Preliminary

The projected catch assumes that the TAC is maintained at 26,000 t until 1984; the biomass in 1985 is expected to exceed 200,000 t and therefore, fishing at the $F_{0.1}$ level is assumed from 1985-90.

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	215	226	230	229	229	239	248
Catch ('000 t)	26	33	34	34	33	35	37
Catch rate index	1.00	1.05	1.07	1.07	1.07	1.11	1.15

Cod: St. Pierre Bank (3Ps)

The TAC for this stock was decreased to a level of 25,000 t in 1978-79 from the initial level of 70,000 t in 1973, but was increased to 33,000 t for 1982-83. Nominal catches were below the TAC level until 1977 but have been above it from 1978-81. In the 1983 assessment, a revision of catch rate data indicated a higher fishing mortality on the stock in recent years than had been previously estimated. This change, together with further evidence of improved recruitment in recent years, implied an $F_{0.1}$ yield in 1985 of 33,000 t. The $F_{0.1}$ yield, assuming recruitment at the long-term average recruitment level was projected to be 51,000 t by 1990. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	25	28	30	33	33	33	41
Nominal Catch ('000 t)	33	38	39	34	38[a]		

[a] Preliminary

The projected catch and age 3+ biomass given below assume that fishing mortality is maintained at $F_{0.1}$.

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	266	289	309	321	328	330	332
Catch ('000 t)	33	41	46	49	52	52	51
Catch rate index	1.00	1.00	1.16	1.21	1.23	1.24	1.25

Cod: North and East Gulf of St. Lawrence (4RS, 3Pn)

Nominal catches averaged 81,000 t for the period 1959-81, equally shared by the inshore and offshore fleets. Historically, the stock has been fished by Canada, France, Portugal and Spain. These latter two countries have been excluded since 1977, whereas France's fishing rights will continue until 1986. Recent nominal catches and TAC's have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	55	75	75	93.3	100	100	100
Nominal Catch ('000 t)	83	98	98	105	103[a]		

[a] Preliminary

Catch rates have increased considerably in the last three years, about 2.25 times the rate between 1976-1978. A historic high was reached in 1982 as a result of above average recruitment. Catches are expected to remain stable between 90,000-100,000 t until 1990. Size of landed fish should also increase substantially. The average long-term catches for this stock will likely be maintained at, or above, 81,000 t.

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	609	613	620	632	639	640	632
Catch ('000 t)	100	100	91	93	95	95	93
Catch rate index	1.00	1.01	1.02	1.04	1.05	1.05	1.04

Cod Stocks in the Western Gulf of St. Lawrence and Eastern Scotian Shelf (4T, 4Vn, 4VsW)

Management of these stocks takes into account the fact that the three main stocks in the area exhibit some seasonal migration among the statistical subdivisions. Subdivision 4Vn has a local stock which provides half of the summer catch. The division also receives winter immigrants from 4T (the southern Gulf of St. Lawrence) and summer immigrants from 4VsW. Taking into account the known stock distributions, the current management rationale is to consider catches in 4T, and in 4Vn during January to April as coming basically from the southern Gulf stock. Catches in 4Vn during May to December are considered to be largely based on local stocks, although there is some immigration from 4Vs to 4Vn during the summer.

Cod: Sydney Bight (4Vn) (May-December)

Local stocks have historically accounted for half the summer catch, although there have been contributions from 4T cod early and late in the seasons, together with summer immigrants from 4VsW. Catches in recent years have been about 10,000 t, roughly the long-term average. The TACs for 1977-1979 (3,500 t) were set in response to reduced abundance of adjacent stocks in 4T and 4VsW and the need to prevent overfishing in 4Vn as a result of the depletion of these stocks. With the recovery of these stocks and indications of increases in the local 4vn stock, this quota was relaxed in subsequent years. It is likely that 1984 landings from this area will be about 9,000 t and it is anticipated that 1985 landings will be the same, or slightly higher.

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	3.5	5	10	14	14	14	10
Nominal Catch ('000 t)	6	10	13	12	9[a]		

[a] Preliminary

Cod: Southern Gulf (4T) and Sidney Bight (4Vn) (January-April)

Most year-classes produced by this cod stock since 1973 have been above average. This, coupled with a management strategy a few years ago of fishing below the calculated $F_{0.1}$ level, has led to a rapid increase in stock biomass. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	46	54	53	60	62	67	67
Nominal Catch ('000 t)	56	55	65	58	67[a]		

[a] Preliminary

The 1983 catch was 67,000 t, the highest since 1963. The exceptional 1979 and 1980 year-classes should sustain catches well above the average until 1990.

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	789	791	804	794	787	771	764
Catch ('000 t)	67	67	77	87	93	93	91
Catch rate index	1.00	1.00	1.02	1.01	1.00	0.98	0.97

Cod: Banquereau - Sable Island (4VsW)

Catches averaged 56,000 t from 1958 to 1976, but declined to 10,000 t in 1977. During the period 1958 to 1976, Spain was the main exploiter of this stock, catching, on the average, 32,000 t each year. Canada followed with approximately 17,000 t. Since 1977, this fishery has become almost 100% Canadian. The decline in catches after 1972 is thought to have been a consequence of reduced recruitment caused by cod by-catches in small mesh fisheries (e.g., for silver hake). To permit rebuilding of the stock, TACs were set at 7,000 t for 1977 and 1978. With increasing controls on small mesh fisheries, the recruitment has improved resulting in TACs of 45,000, 55,600, and 55,000 t for 1980, 1982, and 1984 respectively. Between 1984 and 1990, yield is expected to increase from 55,000 to 75,000 t annually. Recent catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	30	45	50	55.6	64	55	55
Nominal Catch ('000 t)	40	49	54	56	52[a]		

[a] Preliminary

Catch projections and catch rate index to 1990 are as follows:

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	380	416	450	478	501	519	531
Catch ('000 t)	55	55	60	65	70	73	76
Catch rate index	1.00	1.09	1.18	1.26	1.32	1.37	1.40

Cod: Browns Bank (4X)

Historically, cod fishing in this area has been inshore, with catches averaging 15,000 t. With the development of an offshore fishery, catches increased from 1962 to a level of 35,500 t in 1968. A TAC of 5,000 t was placed on offshore cod in this Division in 1975. This was reduced to 4,000 t during 1976-1977 for the southeastern part of 4X and remained in effect until 1982. Subsequently, a TAC of 30,000 t was set for the entire 4X cod fishery. In 1983, and possibly in 1984, the TAC will not be caught. The stock structure in 4X is complex and the status of the inshore stocks is essentially unknown because of difficulties in collecting inshore statistics. It is likely, however, that inshore cod are being exploited at the optimal level. There is evidence that the offshore component is being heavily overexploited. Yield during 1985-1990 should be about the long-term average of 23,700.

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	4[1]	4[1]	4[1]	30	30	30	30
Nominal Catch ('000 t)	28	31	31	32	26[a]		

[a] Preliminary
[1] Regulated in conjunction with haddock offshore stock only

Cod: Georges Bank (5Ze)

Historically, the USA was the main exploiter of this fishery, but subsequently with the addition of the foreign fleets the yield increased from about 11,000 t in 1960 to a peak of 58,000 t in 1966. Catches subsequently declined and the foreign vessels left the fishery by 1977. Recent yields increased from 20,000 t in 1976 to 57,000 t in 1982 with Canada taking 30% of the latter. Indications are that while the 1975 year-class is strong, subsequent year-classes are average and exploitation is in excess of F_{max}. If fishing mortality is reduced to $F_{0.1}$ for the next two-three years then catches of 35-40,000 t can be expected. Long-term yield for 5Ze should be in the order of 33,250 t.

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	35	35	35	35	35	35	45[b]
Nominal Catch - ('000 t)	39	48	42	57	49[a]	-	

[a] Preliminary
[b] TAC subject to USA, Canada agreement. $F_{0.1}$ catch shown.

Pollock: Scotian Shelf and Georges Bank (4VWX + SA 5)

The fishery is centered on Browns Bank (4X), but substantial catches are also made in 4VW and in Subarea 5. Until recently the only known spawning area was Jeffreys Ledge (5Y) but recent ichthyoplankton surveys indicates that spawning also occurs on the Scotian Shelf in the Emerald Bank area. The entire area is still managed as a unit as information on mixing of spawning units during adult life is lacking. A TAC was first introduced in 1973 (for 4X+5), with 4V and 4W being added in a TAC of 55,000 t for 1974-76. The TAC was reduced to 30,000 t for 1977-1979. While the fisheries trends are difficult to interpret due to changes in catchability in recent years, the stock appears to be fairly stable at present. The TAC was raised to 40,000 t for 1980 and to 55,000 t for 1982. The 1984 TAC was 52,000 t. Catches between now and 1990 are expected to be between 40,000 and 45,000 t.

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	30	40	54	55	52	53	53[b]
Nominal Catch ('000 t)	48	55	59	53	47[a]	-	

[a]Preliminary
[b]TAC subject to USA, Canada agreement. $F_{0.1}$ catch shown.

The long-term yield for the Subarea 5-5Ze portion of the stock is estimated to be 6,800 t.

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	291	275	259	251	246	246	245
Catch ('000 t)	53	53	45	43	42	42	42
Catch rate index	1.00	0.95	0.89	0.86	0.85	0.85	0.84

Silver Hake: Scotian Shelf (4VWX)

Exploitation of silver hake on the Scotian Shelf has been almost entirely by the USSR., with Cuba recently entering the fishery. Peak catches occurred in 1963 (123,00 t) and 1973 (300,000 t). The TAC has varied between 70,000 t and 90,000 t during 1977-1981, the variation reflecting pronounced fluctuation in recruitment. The fishery, which is prosecuted largely with small-meshed bottom trawls, generates a by-catch of young fish of other commercial species, depressing their productivity. Minimum codend mesh size used in the directed silver hake fishery was set at 60 mm manilla equivalent as of April 1, 1977.

Difficulty in predicting recruitment limits the usefulness of resource projections to more than one year for this species. For the purposes of this document, it is assumed that a TAC of 70,000-100,000 t will be sustainable through 1990.

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	70	90	80	80	80	80	100
Nominal Catch ('000 t) ('000 t)	52	45	41	60	36[a]		

[a] Preliminary

Haddock: Browns Bank (4X)

Long-term average catches (1931-1960) were 17,000 t, split roughly equally between U.S.A. and Canada. In the mid-1960's, Canada expanded the fishery to a 28,000 t average, total catches reaching a peak of 42,000 t in 1966 as a result of the extremely large 1963 year-class. Decreased recruitment and continued high effort led to catch declines, introduction of a TAC of 18,000 t and a closed spawning area/season in 1970. The stock increased during 1973-1980. Since 1982, the TAC of 32,000 t has not been met, yield being 20-25,000 t annually. Both short and long-term yield prospects for this stock are considerably more pessimistic than previous projections on account of exceptionally high exploitation rates during 1982-1984. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	26	28	32	32	32	20	15
Nominal Catch ('000 t)	25	29	31	24	25[a]		

[a] Preliminary

Catch projections and catch rate index to 1990 are as follows

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	62	64	71	77	82	86	89
Catch ('000 t)	20	15	11	12	13	14	15
Catch Rate Index	1.00	1.03	1.15	1.24	1.32	1.39	1.44

Haddock: Scotian Shelf (4VW)

Catches averaged 28,000 t annually in the 1950s and 1960s. However, recruitment failure followed the fishing out of the 1962 and 1963 year-classes as juveniles, and catches in 1975-1976 averaged only 1,500 t, increasing to 3,300 t in 1977. TACs between 1976 and 1979 were set at 2,000 t to maintain removals at the lowest possible level (by-catches only). The stock appeared to be well on its way to recovery to former levels, but in the past three years, the rate of this recovery has slowed. TACS for 1984 and 1985 are 15,000 t. Future prospects are dependent on the present trend of increased recruitment continuing. The long-term yields should average about 20,000 t per year. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	2	15	23	23	19	15	15
Nominal Catch ('000 t)	3	15	20	15	9[a]		

[a] Preliminary

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	112	122	122	111	98	89	93
Catch ('000 t)	15	15	18	18	15	14	12
Catch rate index	1.00	1.09	1.09	0.99	0.88	0.79	0.74

Haddock: Georges Bank (5Ze)

Nominal catches from Subarea 5 were very stable between 1930 and 1960, ranging between 50,000 t and 60,000 t. However, heavy exploitation in 1965-66 (1965 nominal catch was 155,000 t), based primarily on the exceptionally large 1963 year-class, greatly decreased the population. This, combined with subsequent recruitment failure, has required reduced allowable catches since 1970. Nominal catches reached a low of 5,000 t in 1974. However, the 1975 year-class was strong and nominal catches increased to 22,000 t in 1978. Unless recruitment improves, yield during 1985-1990 will be in the order of 5,000-10,000 t annually. The long-term yield from this stock should be approximately 42,000 t. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	-(1)	-(1)	-(1)	-(1)	-(1)	6(1)	5(1)
Nominal Catch ('000 t)	19	28	5	18	12[a]		

(1) Subject to Canadian and USA domestic regulations for national fisheries.

[a] Preliminary

Catch projections and catch rate index to 1990 are as follows:

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	33	27	30	31	30	29	29
Catch ('000 t)	6	5	6	7	6	6	6
Catch rate Index	1.00	0.82	0.91	0.94	0.91	0.88	0.88

Redfish: Labrador-N.E. Newfoundland (2+3K)

Standardized commercial catch rates have shown a gradual increase from 1976 through 1982 and research survey results suggest that the stock is stable. Since 1980, the TACs have not been caught primarily due to decreased fishing effort. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	30	35	35	35	35	35	35
Nominal Catch ('000 t)	31	15	18	18	15[a]		

[a]Preliminary

The sustainable yield at 2/3 F_{msy} has been estimated at 35,000 t. This corresponds to the present TAC and this level is expected to be maintained through 1990.

Redfish: Flemish Cap (3M)

The 1981 catch rate was the highest since 1970 due to recruitment to the fishery of the successful year-classes of the 1970's. It is anticipated that catch rates will decrease once these year-classes have passed through the fishery because subsequent year-classes are poor. Recent catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	20	20	20	20	20	20	20
Nominal Catch ('000 t)	20	16	14	15	20[a]		

[a]Preliminary

Redfish: Eastern Grand Bank (3LN)

Catch rates have been increasing since 1978 due to recruitment of the strong, early 1970's year-classes. The wide range of lengths taken in the commercial fishery also tends to indicate that the stock is in a healthy condition. Recent catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	18	25	25	25	25	25	25
Nominal Catch ('000 t)	14	16	24	22	20[a]		

[a] Preliminary

It is anticipated that the TACs will not need to be decreased below 25,000 t through 1990.

Redfish: Southwestern Grand Bank (3O)

Catch rates show considerable fluctuations from year to year, but have generally increased since the mid-1970's. In 1981 and 1982, only about 50% of the TACs were taken, this being primarily due to decreased effort. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	20	21.9	20	20	20	20	20
Nominal Catch ('000 t)	18	17	13	11	7[a]		

[a] Preliminary

The MSY level of 20,000 t corresponds to the TAC through 1984 and it is expected that this level could be maintained in the foreseeable future.

Redfish: St. Pierre Bank (3P)

Commercial catches in 1982 contained a wide range of sizes and research data indicate relatively large numbers of fish ages 2-4 and 6-10 in the area. Furthermore, catch rates increased from the mid to late 1970's, but stabilized in the early 1980's and it appears that the stock is in a stable condition. The TACs have however, not been achieved from 1978 onwards, but this was due to a lack of fishing effort. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	16	18	18	18	18	18	18
Nominal Catch ('000 t)	10	8	9	6	7[a]		

[a]Preliminary

The low fishing effort and related low fishing mortalities did not permit an assessment in 1983. Therefore, the 1982 $F_{0.1}$ level of 18,000 t was maintained for 1984 and the 1985 TAC has been maintained at the same level as in recent years. Catches in future are uncertain, but for planning purposes 18,000 t is assumed to 1990.

Redfish: Gulf of St. Lawrence (4RST)

Nominal catches decreased from a peak of 130,000 t in 1973 to 14,000 t in 1978 and increased afterwards to 26,000 t in 1982. Commercial catch rates declined from 1972 to 1977, and have increased sharply since then to reach the 1966 level. This increase is due to the recruitment of the strong year-classes of the early seventies. Recent TAC's and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	16	16	20	28	31	50.6	50.6
Nominal Catch ('000 t)	15	15	21	26	24[a]		

[a]Preliminary

Year-classes of the mid-seventies appear weak, while those of the late seventies appear strong. Projections of catches at $F_{0.1}$ indicate catches of 50,600 t for 1984 declining slowly to 48,000 t in 1990 under the current strategy. The year-classes presently in the fishery should be able to sustain catches around 50,000 t until about 1987-1988. But subsequent poor recruitment from the late 1970's year-classes is expected to produce a decline in the adult biomass from 1985-1990. The 1981 and 1982 year classes appear to be strong and could lead to increases in catches in the 1990's.

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	701	671	636	603	563	534	512
Catch at $F_{0.1}$ ('000 t)	50.6	50.6	55	55	60	51	48
Catch Rate Index	1.00	0.96	0.91	0.86	0.80	0.76	0.73

Redfish: Scotian Shelf (4VWX)

The MSY for this stock is estimated to be approximately 30,000 t, slightly less than the average catch from 1965 to 1974 (peak catch was 62,000 t in 1971). Fishing mortality in the early 1970's, is believed to have substantially exceeded the level which would give the MSY yield. In recent years, commercial and research vessel abundance indices indicate a resurgence of biomass with a drop in exploitation rates. Both the short and long-term yields from this resource should be around 30,000 t annually.

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	20	30	30	30	30	30	30
Nominal Catch ('000 t)	13	14	19	16	13[a]		

[a] Preliminary

White Hake: Southern Gulf of St. Lawrence (4T)

This is a seasonal, localized fishery carried out mainly by inshore vessels of under 25 GRT. Gillnetters (35%) and small draggers (33%) account for the majority of the catch.

Until 1982, this was an unregulated fishery. The catches and TAC's in recent years have been:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	-	-	-	12	12	12	12
Nominal Catch ('000 t)	8	12	14	10	9[a]		

[a] Preliminary

As a result of inadequate data, it has not been possible to carry out analytical assessments of this stock. Research vessel survey data indicate general stability of the stock biomass, although research catches have been very small. This stability, coupled with the poor data base, suggests little basis for a change in catch level before the late 1980's.

White Hake: Scotian Shelf (4VWX)

Nominal catches in the late 1970's, averaged 4,300 t per year, almost all of the catch being taken by Canada. Two-thirds of these catches came from Division 4X. Catches averaged 5,100 t from 1970-74 and 3,600 from 1975-79. The lower catches during the late 70's may reflect changing fishing patterns rather than a change in stock abundance. Catches from 1980-82 averaged 4,000 t and they can be expected to continue at around this level during the 1980's.

Year	1979	1980	1981	1982	1983
Nominal Catch ('000 t)	3	4	4	5	4[a]

[a] Preliminary

American Plaice: Labrador-Northeast Newfoundland (2+3K)

The fishery on this stock has been conducted mainly by Canadian vessels since 1977, and has usually been concentrated in NAFO Div. 3K. Nominal catches and TACs for recent years have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	6	6	6	10	10	10	10
Nominal Catch ('000 t)	3	5	7	2	2[a]		

[a] Preliminary

The last analytical assessment of this stock, performed in 1981, indicated an $F_{0.1}$ catch for 1982 of 10,000 t. Research vessel surveys since this time have shown that abundance estimates for plaice in Div. 2J have increased while those for Div. 3K are at about the same level. Since 1976, effort by Canadian offshore trawlers has fluctuated annually, although CPUE has remained relatively constant. Thus, this stock appears to be in good condition and there are indications that increased catches may be possible in Div. 2J. However, it seems unlikely that the 10,000 t TAC will be taken in 1984 and it appears that future catches may be related to the availability of cod quotas to the offshore trawler fleet.

American Plaice: Grand Bank (3LNO)

The fishery on this stock has been conducted almost exclusively by Canadian vessels since 1977, with the largest part of the catches during this time coming from Div. 3L. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	47	47	55	55	55	55	49
Nominal Catch ('000 t)	49	49	50	51	38[a]		

[a] Preliminary

Catch rates for Canadian otter trawlers in Div. 3LN increased significantly over the period 1977-83. Canadian research vessel surveys conducted annually have indicated relatively stable population abundance since 1977.

The following shows the results of stock projections to 1990 for Div. 3LN only based on the most recent assessment of the stock:

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	402	407	413	417	419	420	420
Catch ('000 t)	47	44	46	48	49	49	50
Catch Rate Index	1.00	1.01	1.03	1.04	1.04	1.04	1.04

From this table, it can be seen that the population biomass in Div. 3LN is predicted to increase slightly and that forecasted catches from these Divisions should be approximately 45,000-50,000 t per year from 1985-90. Catches for the entire stock area including Div. 3O (where catches averaged 4,300 t during the 1978-82 period) should remain in the 50,000-55,000 t range throughout the 1980's.

American Plaice: Flemish Cap (3M)

Nominal catches decreased from 4,000-5,000 t in 1965-66 to 1,500 t in 1974-77 and has remained at that level during recent years. A precautionary TAC of 2,000 t was set in 1974. This was raised briefly to 4,000 t in 1978 but was reduced to 2,000 t again in 1979, and has remained at that level since. The TAC is likely to remain at 2,000 t to 1990. However, since this species is taken mainly as a bycatch in the cod fishery, increased cod catches could result in reductions in plaice biomass.

	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	2	2	2	2	2	2	2
Nominal catch ('000 t)	1	1	1	1	2[a]		

[a] Preliminary

American Plaice: St. Pierre Bank (3Ps)

The fishery for American Plaice in Subdiv. 3Ps is conducted primarily by Canadian otter trawlers, with a substantial portion of the catch being taken as a bycatch in other fisheries. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	4	5	5	5	5	5	5
Nominal catch ('000 t)	4	3	3	2	2[a]		

[a]Preliminary

Catch rates in the small directed fishery by Canadian trawlers indicate a relatively stable stock size. Research vessel abundance estimates, while variable between years, also indicate that the stock size appears to have been stable over the past 4-5 years. Therefore, TACs in the next few years should remain at or near the present level of 5,000 t.

American Plaice: Southern Gulf of St. Lawrence (4T)

The plaice fishery in the southern Gulf of St. Lawrence is a bycatch fishery. The smaller fish which constitute a considerable portion of the catch are normally discarded at sea. Discarding causes inaccurate estimation of removals at age when these are based on sampling of commercial landings which makes assessment of the stock difficult. The catches and TACs in recent years have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	10	10	10	10	10	10	10
Nominal Catch ('000 t)	11	9	8	7	7[a]		

[a]Preliminary

Two independent abundance indices (commercial catch rate and research vessel biomass index) indicate a possible decline in stock size.

Witch: Labrador-Northern Grand Bank (2J+3KL)

Research vessel survey data indicate that most of the stock biomass for this management unit is located in Div. 3K. There has been recent evidence to indicate that at least three spawning populations occur throughout the management area. The stock biomass is at present, relatively stable and fishing at $F_{0.1}$ should yield an annual catch of 8,000 t, which is likely to be maintained to 1990. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	17	17	8	8	8	8	8
Nominal Catch ('000 t)	4	3	4	3	3[a]		

[a] Preliminary

Witch: Southern Grand Bank (3NO)

Catch rates from Canadian otter trawlers have increased over the period 1979-82. These catch rate estimates are however, based on relatively small catches and should be treated cautiously. Recent assessments indicate a shift in the age composition to younger fish which are larqer at age than in the past.

Indications are that under present conditions, annual removals of 5,000 t would generate a fishing mortality near that of $F_{0.1}$ and this status is expected to continue to 1990. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	7	7	5	5	5	5	5
Nominal Catch ('0000 t)	3	2	2	4	4[a]		

[a] Preliminary

Witch: South Newfoundland (3Ps)

Historically, the catch of witch flounder in this area has been taken as a by-catch in other groundfish fisheries on St. Pierre Bank, with some directed catches by gillnets and seiners in Fortune Bay. In 1981 and 1982, most of the total catch in Subdiv. 3Ps came from Fortune Bay which has been shown through stock identification studies to support a separate stock from that on St. Pierre Bank. The fishery on the St. Pierre Bank stock for practical purposes was therefore negligible in these years. The TAC is expected to remain at 3,000 t to 1990. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	3	3	3	3	3	3	3
Nominal Catch ('000 t)	1	1	0.5	0.5	0.4[a]		

[a] Preliminary

Witch: Northern and Eastern Gulf of St. Lawrence (4RS)

Witch landings were spread relatively evenly between NAFO Divisions 4R and 4S in the Gulf until 1973, however, since then there has been a shift in landings to the eastern Gulf (4R).

The catches and TACs in recent years have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	5	5	5	3.5	3.5	3.5	3.5
Nominal Catch ('000 t)	3.8	3	1.2	2	1[a]		

[a] Preliminary

Although catches have decreased, recent commercial and research vessel abundance indices suggest a stable stock. There were no research vessel surveys in 1983 or 1984 and little commercial sampling data is available. There is therefore, unlikely to be any basis upon which to change the current TAC advice in the foreseeable future.

Flatfish: Scotian Shelf (Plaice, Witch, Yellowtail, and Winter Flounder) (4VWX)

Plaice make up 65 percent of all flatfish catches in these divisions. A combined quota of 28,000 t for plaice, witch, and yellowtail (which is mainly a bycatch fishery) was introduced in 1976.

American Plaice - Catches since 1970 for American plaice on the Scotian Shelf have averaged 9,688 t. The peak catch was recorded in 1974 at 16,772 t. Since then catches have declined and in 1981 and 1982 catches were lowest in the decade, ranging from 5,300-6,700 t. Research surveys indicate a slight decline in the plaice population abundance until 1975, but subsequently the stock has remained stable to 1982.

Witch Flounder - Peak landings of witch flounder occurred in 1968 and 1971 at 22,000 t and 18,000 t respectively. Since 1971, a decline in landings has occurred and the nominal catch for 1982 is only 6 percent of the catch in 1971. This may be related to lack of direct fishing effort, rather than to a collapse of the resource. Total population estimates made from research cruises suggest a gradual decline from 1975-1979 with a slight increase taking place in the last 3 years.

Yellowtail Flounder - Landings of yellowtail flounder have been highest in 4V. Nominal catches fluctuated between 4,000 and 5,000 t in 1963-1967 with a peak of 13,000 t in 1968. Since 1969, landings have decreased from approximately 4,000 to a low of 900 t in 1976. Between 1977-1982 an increase in landings to 2,900 t has occurred. Abundance indices from research cruises imply that between 1970-1976 a slight population increase occurred, but from 1976-1982, there was a decrease.

Winter Flounder - This species is taken in an inshore small boat fishery yielding between 700 t and 3,100 t per year (1,200 t in 1982).

Nominal catches of these regulated species and TACs in recent years have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	14	14	14	14	14	14	14
Nominal Catch ('000 t)	12	13	13	10	10[a]	-	

[a]Preliminary

In 1978, TACs for all flatfish except winter flounder were reduced to 14,300 t, half of that in effect for 1975-1977. This substantial decrease in allowable catch was implemented because of uneconomic catch rates which were experienced in the Canadian fishery. The TACs for 1978-1984 of 14,0000 t should allow rebuilding of the different stocks.

Winter Flounder: Southern and Western Gulf of St. Lawrence (4T)

This is a seasonal localized inshore fishery. The catches are generally in the order of 2,000 tonnes with the majority (over 95%) being taken in the southern Gulf of St. Lawrence. The catches in recent years have been as follows:

Year	1979	1980	1981	1982	1983
Nominal Catch ('000 t)	1.7	2	2	2.3	2[a]

[a]Preliminary

The limited commercial catch per unit effort data do not indicate a changing stock biomass. Analytical assessments are not possible with the limited data base available.

Yellowtail: Grand Bank (3LNO)

This fishery is conducted mainly by Canadian otter trawlers with recent catches being in the 15-20,000 t range. Nominal catches and TACs for recent years have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	18	18	21	23	19	17	15
Nominal Catch ('000 t)	18	12	15	12	9[a]		

[a] Preliminary

Catch rates for Canadian trawlers increased steadily over the period 1976-1980, and then declined slightly in 1981 and 1982. Candian research vessel surveys in Div. 3LN indicated a relatively stable population size since 1978.

Stock projections to 1990, based on the latest assessment of the stock are as follows:

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	32	31	31	32	33	33	33
Catch ('000 t)	17	15	16	16	17	17	17
Catch Rate Index	1.00	.97	.97	1.00	1.03	1.03	1.03

TACs of yellowtail in Div. 3LNO will likely remain at 16,000-17,000 t in the period 1984-90 if fishing is maintained at $F_{0.1}$ level.

Greenland Halibut: Davis Strait (0+1)

No new commercial data have been available since the stock was last assessed in 1978. Recent research biomass estimates, indicate a large unexploited biomass in the slope waters of Div. 0B. No biomass estimates are available for Subarea 1 where the main fishery is located. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	25	25	25	25	25	25	25
Nominal Catch ('000 t)	19	8	6	7	6[a]		

[a] Preliminary

Greenland Halibut: Labrador-Northern Grand Bank (2+3KL)

From available biological data and tagging information, it is considered that the major spawning area of Greenland halibut is located in Davis Strait at about 67°N. The spawning components are thought to come from both 2+3KL and Subarea 0+1. Because of the appearance in recent years of larger than average year-classes and low levels of exploitation, it appears that mortality due to fishing is presently having little effect on this stock. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	30	35	55	55[b]	55[b]	55[b]	55[b]
Nominal Catch '000 t)	34	33	31	26	22[a]		

[a] Preliminary
[b] 55,000 t applies only to Div. 2J+3KL with an additional 20,000 t applying to Div. 2GH from 1983 to 1985.

In previous assessments of this stock, concern was expressed that competition may occur between inshore gillnet fishermen and offshore trawler fishermen, particularly in Division 3K. It was advised that any increase in the TAC for this stock should be directed to Div. 2G and 2H and, in fact, Canada set a TAC of 20,000 t in Division 2GH in 1983 and 1984. Recent investigation indicate that a TAC of 75,000 t in 1985 for Subarea 2 and Divisions 3K and 3L, based on fishing at $F_{0.1}=0.29$, would be conservative. The long-term projection is that the TAC will remain at 75,000 t for SA2+3KL as a whole, until at least 1990.

Greenland Halibut: Gulf of St. Lawrence (4S)

This was a bycatch fishery of the northern Gulf shrimp fishery until 1978. Since then the biomass has increased due to the strong 1973-1975 year classes. These new year classes led to a dedicated gillnet fishery along the north shore of Québec. Catches and TACs of recent years have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	-	-	-	7.5	5	5	5
Nominal Catch ('000 t)	9	7	3	2	1[a]		

[a] Preliminary

Recent research vessel surveys indicate a stabilisation of biomass since 1981, with a strong 1979 year-class about to recruit. Due to the bycatch nature of the shrimp fishery component and the opportunistic nature of the directed gillnet component, this fishery is difficult to manage but catches should remain stable until 1986 or 1987.

Roundnose Grenadier: Labrador-Grand Bank (2+3)

The data available for this stock are very limited. The low catches in recent years may be, in part, due to limitations in the permitted bycatch of Greenland halibut but catch rates have continued to decline since the early to mid-1970's and TACs have been reduced from the 32,000-35,000 t of the late 1970s to 11,000 t since 1983. Recent catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	35	30	27	27	11	11	11
Nominal Catch ('000 t)	8	2	7	2	1[a]		

[a] Preliminary

The TAC level is not likely to be increased in the foreseeable future.

Argentine: Scotian Shelf and Georges Bank (4VWX)

In the Northwest Atlantic, argentines are most abundant along the edge of the Scotian Shelf and in the Fundian Channel, in depths of about 200-500 m, and it is in this area that the commercial fishery has concentrated. Argentine are also, at times, abundant on the eastern slope of Georges Bank. Catches have been sporadic, ranging from 49,000 t in 1966, to less than 500 t in 1981 and 1982, depending on whether USSR, and more recently,Japanese fleets conducted directed fisheries. Recent nominal catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	20	20	20	20	10	-	10
Nominal Catch ('000 t)	3	2	0.5	0.40	1[a]		

[a] Preliminary

Effort was reduced after 1976, as an important part of the species distribution lies in and close to the USA-Canada disputed zone, limiting opportunities for third party fishing. Failure of the Scotian Shelf squid fishery has also reduced effort as argentine fishing was largely ancilliary to it, at least for the Japanese fleet. Most recent estimates of sustainable yield for the Scotian Shelf (4VWX) stocks is 10,000 t.

Other Finfish: Labrador Grand Bank

In the long term, annual catches of 20,000 t of other groundfish may be expected from this area, including catches from presently unregulated stocks of such species as white hake, wolfish, pollock, witch, yellowtail, and Atlantic halibut.

Other Finfish: Gulf of St. Lawrence (4RST)

The total landings of other finfish in the Gulf of St. Lawrence remains at about the same level as other years. Fisheries for two species namely white hake and Greenland halibut are now subject to regulation and thus, the total landed weight of this category appears to be less than in other years. Landings have varied in recent years from 600 t in 1980 to 1,600 t in 1981. Landings of unregulated species can be expected to fluctuate in the long term, but should be about 30,000 t annually.

Other Finfish: Scotian Shelf (4VWX)

Catches of finfish in 4VWX other than those reported on in detail elsewhere in this report, have been 12-14,000 t in the last five years (1978-1982). Almost a quarter of this is unspecified finfish, mainly groundfish, and represents small quantities of many species, including the major species, which have not been assigned to species for one reason or another. Most of the remainder are groundfish of quite limited abundance; cusk (35%), wolffish (16%) and Atlantic halibut (11%), which are probably close to full exploitation. Greenland halibut (3%) and red hake (3%) are at their southern and northern limits,respectively on the Scotian Shelf and these small populations offer no scope for significant increases in catch. The remaining, approximately 10% of the catch, has been accounted for by anglers, skates, dogfish, and large sharks, primarily porbeagle. Yields from these species could be increased to some extent, if markets could be found. Species which do not presently appear in catch statistics, but which offer potential for fisheries development are sand launce and, possibly, Atlantic saury. Such development would require innovations in harvesting technology as well as in marketing.

Year	1979	1980	1981	1982	1983
Nominal Catch ('000 t)	13	14	12	12	15[a]

[a] Preliminary

PELAGIC FISH

Herring

All herring stocks on the Atlantic coast are either fully exploited, or over-exploited. Future catch levels should fluctuate primarily as a result of natural fluctuations in recruitment.

Herring: Newfoundland

As the result of poor recruitment, the herring stocks in the Newfoundland east and south coast areas have continued to decline in the early 1980's. If recruitment returns to the historically observed pattern, stocks could rebuild by the late 1980's and be able to support catches of 20,000 t along the east coast and 8,000 t along the south coast. The following are the nominal catches and TACs for 1979-84 period:

Year		1979	1980	1981	1982	1983	1984
East Coast Nfld.	TAC ('000 t)	20.8	9.8	7.0	2.0	0.0	2.0
	Nominal Catch ('000 t)	26.4	12.4	9.2	2.5	0.6[a]	1.8[a]
Placentia St. Mary's	TAC ('000 t)	3.4	2.5	1.2	0.0	0.0	0.0
	Nominal Catch ('000 t)	3.5	2.4	0.7	0.05	0.04[a]	0.06[a]
Fortune Bay	TAC ('000 t)	1.0	1.0	0.2	0.0	0.0	0.0
	Nominal Catch ('000 t)	1.2	0.5	0.06	0.02	0.02[a]	0.02[a]

[a] Preliminary

Herring: West Coast Newfoundland (4R)

Nominal catches in 4R declined from 19,000 t in 1980 to 10,000 t in 1982, in parallel with a trend of declining stock biomass. In the absence of substantial incoming recruitment, the trend of declining biomass will continue in the 1980's, since major year-classes (1968-1969) will gradually disappear through fishing and natural mortality.

Observations made from purse seine vessels in the fall fishery of 1982 and the spring fishery of 1983, suggest that recruitment might be improving, but some years will pass before the small fish grow big enough to enter the fishery and the importance of this group can be assessed. The autumn spawning biomass has declined steadily since 1966, when it represented 75% of the total biomass, to 6% of the 1983 total biomass. The spring spawning component has, on the other hand, remained fairly stable from 1966-1972 and increased to a maximum in 1974 due to the 1968 year-class, but has been in decline since. From the 1984 assessment it is clear that the declining trend in biomass will continue to characterize the 4R herring stock, until the 1979 year-class recruits and future trends will depend upon the actual size of that year-class. Recent nominal catches and TAC's have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	12.5	18.0	16.0	10.0	10.0	10.0	11.0
Nominal Catch ('000 t)	18.3	19.1	13.2	10.6	8.7[a]		

[a]Preliminary

Catch projections and catch rate index to 1990 are as follows:

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass	63	59	54	52	51	50	49
Catch ('000 t)	10.0	11.0	9.7	9.1	8.7	8.4	8.2
Catch Rate Index	1.0	0.94	0.86	0.83	0.81	0.79	0.78

Herring: Southern Gulf (4T)

The 1984 population estimate of spring spawners was composed mainly of the 1979 year-class (64%) and the population biomass is 10% the historic maximum of 600,000 t. Similarly, the autumn spawning component is 10% of the historic 1965 maximum of 1,200,000 t. The stock is not expected to greatly improve in the short term, although autumn spawner recruitment has been better than for spring spawners. Catches in 1983 were dominated by the 1977 and 1979 autumn spawner year-classes.

Nominal catches of 4T herring reached a peak of 300,000 t in 1970. The average catch between 1972 and 1980 was about 45,000 t. From 1975 to 1980, TACs were not taken, but catches exceeded the TACS from 1981 to 1983. TACs and nominal catches have been as follows:

	1979	1980	1981	1982	1983	1984	1985
TAC	55	55	16	15	20	18	20
Nominal Catch	48	41	22	24	26[a]		

[a]Preliminary

Under-reporting of catches apparently occurred again in 1983. In addition, poor markets led to more frequent discarding in 1983 than in previous years. Tagging experiments indicate that part of the catches from the winter fishery in Subdiv. 4Vn consists of herring which spawn in Division 4T. Due to difficulties in quantifying this component of Subdivision 4Vn herring catches, only catches from Division 4T have been included in this assessment.

Herring: Scotian Shelf including Bay of Fundy (4VWX)

Herring in 4VWX are divided into two management units namely 4Vn and 4WX. Tagging results have indicated a strong relationship between herring in Chedabucto Bay (4Wa) and those in the western Bay of Fundy (4X). These two areas are therefore, managed as a single unit. Herring from the Gulf of Maine, also mix with herring from the Bay of Fundy, but mixing is not included in management considerations. The origin of herring in 4Vn appears to have changed. The early tagging results as well as the analysis of biological characteristics of herring overwintering in 4Vn, did not permit a clear association with either the Gulf of St. Lawrence (4T) or Scotian Shelf stocks. Recent tagging results as well as changes in the fishing patterns in 4Vn have indicated that Gulf of St. Lawrence herring are now being primarily exploited.

Catches in 4Vn declined from over 15,000 t in the early 1970's, to less than 3,000 t in 1980, but have since stabilized at approximately 3,600 t due to quota and stock limitations. The 1983 quota of 3,000 t was set in an attempt to protect local and overwintering stocks. Future catch levels are unpredictable as they are dependent on recruitment successes in the Gulf of St. Lawrence and Bay of Fundy stocks. Recent TACs and nominal catches have been follows:

Year	1979	1980	1981	1982	1983	1984	1985
			4Vn				
TAC ('000 t)	8	3	4.5	3	5	3.5	3.5
Nominal Catch ('000 t)	3	3	4	4	4[a]	-	
			4WX				
TAC ('000 t)	99	65	100	80.2	82.0	80	91
Nominal Catch ('000 t)	59	110	88	85	82.7[a]	-	

[a]Preliminary

During 1977-1983, the TAC for the 4WX stock fluctuated between 65,000-110,000 annually. The 1984 TAC is set at 80,000. Since 1982, the TAC has either always been met or exceeded. The 1976 year-class, which maximized its biomass in 1980, represented 18% of the total population biomass in 1983. The 1979 year-class now dominates the population (28%). If future recruitment is similar to that observed in the early 1960s, a sustained yield in excess of 100,000 is possible.

4WX

Year	1984	1985	1986	1987	1988	1989	1990
Population Biomass ('000 t)	367	391	406	406	414	423	423
Catch ('000 t)	80	91	95	95	98	101	101
Catch rate index	1.00	1.07	1.11	1.11	1.13	1.15	1.15

Herring: Gulf of Maine (5Y), and Georges Bank and South (5+6)

The Gulf of Maine stock (5Y) has traditionally been managed separately from that on Georges Bank and south (5Z+6). Both adult stocks have remained at seriously depleted levels for several years due to overfishing in the late sixties and early seventies.

The Georges Bank fishery has shown no evidence of recovery and thus, the projected future catches are uncertain. Essentially, no herring have been caught on Georges Bank since 1978, compared to a high of 370,000 t in 1968.

A temporary improvement in the Gulf of Maine adults, following recruitment of the strong 1976-77 year-classes has not been sustained. Subsequently, the apparent low levels of recruitment and high exploitation levels in the U.S.A., has no doubt, contributed to the low catch levels in the inshore fisheries along the Marine-New Brunswick coast. Recovery of either stock would be signaled by the appearance of a large year-class. If this attracts too much effort or is used to maintain current high levels of exploitation by the U.S.A. juvenile fisheries, then recovery to historical levels will not occur. If there is appropriate regulation of the U.S.A. fishery on juvenile herring in the Gulf of Maine, it should be possible to return to the historical adult catch levels of about 30,000 t.

Mackerel: Northwest Atlantic (3-6)

Mackerel stocks from Newfoundland southwards are managed as a unit. Although two stock components have been identified - spawning in the Gulf of St. Lawrence and south of Cape Cod - their degree of mixing and relative contributions to the fishable stock are not yet known.

Considerable difficulty exists in determining population sizes and mortality rates for this stock, but recent stock assessments suggest that catches of 100,000 t would not be harmful to the stock. An even higher TAC would be expected in future years if strong year-classes are detected. Since this is a transboundary stock, management measures will depend on Canada/U.S.A. agreements.

Canadian coastal fishing effort has depended largely on market conditions, and catches have been dependent on local availability of the fish rather than the overall abundance. Catches of mackerel in Subareas 3-6 declined rapidly from 1972 to 1977 due to the decline of the offshore fishery in Subarea 5 and 6, and have stabilized around 30,000-35,000 t since 1978. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984
TAC ('000 t)	-	-	-	-	-	-
Nominal Catch ('000 t)	33	25	28	26	25[a]	

[a] Preliminary

Capelin: Labrador and Grand Bank (2+3)

The lack of refined estimates of capelin biomass levels, together with substantial fluctuations in recruitment, and the complexity of relationships with predator species of fish and mammals render yield predictions difficult. Large fluctuations in recruitment which affect total biomass levels will result in large variations in the TAC on an annual basis. This has been evident in recent years; TAC's in the late 1970's and early 1980's were reduced because of poor recruitment. The presence of the strong 1979 year-class resulted in large biomasses in 1982 and 1983. In view of the very great uncertainties about annual recruitment, no annual projections have been provided for the years 1985-90. However, the difficulties associated with estimating capelin abundance and the expected increase in predator stocks, suggest that the TAC for capelin in Subarea 2+3 will not reach the levels experienced in the mid-1970's and will not exceed 200,000 t.

Year		1979	1980	1981	1982	1983	1984	1985
2+3K	TAC ('000 t)	75	5	10	13	21	100	
	Nominal Catch ('000 t)	11	6	12	14	14[a]		
3LNO	TAC ('000 t)	10	16	30	30	30	38	60
	Nominal Catch ('000 t)	12	14	25	27	25[a]	-	-

[a] Preliminary

Capelin: Gulf of St. Lawrence (4RST)

Annual catches of approximately 8,000 t were realized in the Gulf of St. Lawrence in 1978 and 1979, but these declined in 1980-1981 to 200 t in 1982. Provided that fishing does not concentrate on local spawning groups, sustainable catches could be increased to 30,000 t. The TAC should be partitioned to protect spawninggroups: 10,000 t for division 4T and western 4S, and 20,000 t for division 4R and eastern 4S. Additionally, no more than 6,000 t be taken in any one statistical district in the 4R-eastern 4S area and no more than 5,000 t be taken from 4T, thus leaving 5,000 t to be available in western 4S. Recent catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
TAC ('000 t)	30	30	30	30	30	30	30
Nominal catch ('000 t)	0.5	5.9	2.2	0.1	1.0[a]		

[a] Preliminary

Bluefin Tuna

Management of this highly migratory species is coordinated internationally by the International Commission for the Conservation of Atlantic Tuna (ICCAT); Canada's domestic regulations are designed to implement an agreement under ICCAT to limit harvesting effort to recent levels.

The Canadian fisheries currently depend almost entirely on older and bigger fish that migrate into Canadian waters during the summer. Large scale diversion of foreign effort from the eastern to the western Atlantic in recent years increased the catches of fish of the large sizes. It also increased the danger of an adverse effect on the reproductive potential of the stock spawning in the Gulf of Mexico, far south of the Canadian fisheries zones. Regulations introduced by ICCAT for 1982-84 have, however, drastically reduced this fishery. The effectiveness of measures designed to protect recent year-classes has yet to be demonstrated fully. However, it now appears that the strong 1973 year-class in the western Atlantic will have only a temporary effect upon adult stock abundance and reproductive potential and it will be necessary to protect any future strong year-classes.

Future Canadian catches will depend critically on the degree and effectiveness of management control exercised over the next few years on all age groups.

In the meantime, catches of large fish in Canadian waters are expected to remain low and variable.

Swordfish

At full potential, the annual substainable catch of swordfish along the north American coast is estimated at about 5,000 t (at an average live weight of 70 kg). In 1978, Canadian vessels were estimated to have caught 2,300 t, which was transferred at sea to U.S. vessels. In 1979, permits were issued to Canadian vessels to tranship fish in Canadian ports as well. It is estimated that a total of 2,970 t was either landed or trans-shipped at sea in 1979 and that this level of catch was reached again in 1980. In addition, however. U.S.A. fisheries have developed in recent years off the Carolinas, off Florida and in the Gulf of Mexico; these fisheries probably take as much fish by weight as the Canadian fisheries but include greater numbers of small fish which may reduce the potential long-term yield. Canadian catches in the future are likely to depend on agreements reached with the U.S.A. as to joint management of this migratory species. It is unlikely, that catch levels of Canadian fisheries will exceed 2,500 t in the 1980's, since the total catches by U.S.A. and Canada in 1979 and 1980 probably exceeded the optimum catch levels.

ANADROMOUS AND CATADROMOUS FISHES

Atlantic Salmon: General

Future catches in all local areas will require renewed emphasis on meeting spawner needs at the present time if catch levels are to recover from the current low levels. Catches in individual areas will depend on local fishery regulations, catches in the distant parts of the range at sea, local exploitation pressures, and local vigilance in maintaining Atlantic salmon freshwater habitats. Human activities continue to debilitate the ability of rivers to support good populations, notably the stream alterations caused by transportation, forestry, agriculture, and power developments.

Atlantic Salmon: Newfoundland and Labrador*

The landings in the commercial and recreational salmon fishery 1979-84 are given below. The low abundance in 1978 and 1979 are indicative of low spawning escapement in those years which is expected to result in low abundance and therefore, low landings in 1984 and 1985 when the progeny from the 1978/1979 spawners enter the fisheries. Subsequent to 1985, salmon abundance is expected to increase, which may allow increases to take place in landings.

Year	1979	1980	1981	1982	1983	1984
Commercial (t)	986	2,102	1,910	1,320	1,029	800[a]
Recreational (fish)	36,438	42,460	53,756	47,844	38,602	43,121[a]

[a] Preliminary

Atlantic Salmon: Scotia-Fundy

Commercial catches of salmon in the Scotia-Fundy Region fell from 158 t in 1967 to under 33 t in 1983. Even during the nine-year partial commercial fishing ban in New Brunswick, the Region's commercial catch averaged near 43 t. The declining catches exacerbate the problem of allocation of the available fish among spawning escapement, angling, commercial catch, Indian food fisheries, and homewater and distant domestic sea fisheries. Regional commercial catches are projected to decline on the long-term because of the policy of decreasing the commercial fishery participation by attrition. Decreases in natural production as a result of the recent period of insufficient spawning escapements will be offset to a considerable degree by improvements in the quality and quantity of fish reared for stocking by the federal fish culture system. A trend toward localizing the commercial fisheries on stocks near their home river mouths will result in long-term changes in the structure of the commercial salmon fishery. Continued limitation of the West Greenland salmon fishery, at or below its current level, must be sustained to reduce the drain on naturally-produced stocks and to improve the economics of the Regional enhancement program.

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*Newfoundland and Labrador does not include catches from west Newfoundland (see Gulf)

Atlantic Salmon: Gulf

There are 140 salmon rivers in the Gulf Region. The largest stock complexes in the Maritimes are found in the Restigouche, Miramichi, and Margaree rivers. There are over 80 stocks in Western Newfoundland.

Yield of Atlantic salmon in the Maritimes part of the Gulf Region is only 10% of historical levels. This is primarily due to over-harvesting of large salmon in all fisheries. Over-harvesting of large salmon is also a serious problem for stocks in Western Newfoundland. Prospects for future yields will not improve unless more salmon are allowed to spawn.

Restigouche[b]

Nominal Catch (t)

Year	1979	1980	1981	1982	1983	1984
Sport	22	31	29	14	21	8
Commercial	3[a]	5[a]	29	18	16	17[c]

[a] Commercial ban, incidental catches only.
[b] Native fishery not included.
[c] Preliminary

Miramichi[b]

Nominal Catch (t)

Year	1979	1980	1981	1982	1983	1984
Sport	111	54	42	29	19	21[c]
Commercial	20[a]	59[a]	39	47	41[c]	0[c]

[a] Commercial ban, incidental catches only
[b] Native fishery not included
[c] Preliminary

Margaree

Nominal Catch (t)

Year	1979	1980	1981	1982	1983	1984
Sport	1.3	0.5	2.2	1.7	1.3	0.2[a]
Commercial	8	24	16	27	22[a]	13[a]

[a] Preliminary

Arctic Char

Landings of char from 1978-82 have remained relatively stable between 200 and 250 t. In 1983, landings declined to 150 t due to lower abundance in the inshore areas, and reduced effort due to coastal ice conditions off Labrador. Similarly, due to ice conditions again in 1984, landings declined to 123 t. Landings are expected to decline slightly due to the cessation of the commercial fishery in the Hebron-Saglek Fjord area. Higher yields are possible in northern areas. Recent TACs and nominal catches in the Nain area of Labrador have been as follows:

Year	1979	1980	1981	1982	1983	1984
TAC (t)	83.5[a]	83.5[a]	80.5[a]	116.2[a]	108.0	111.2[a]
Nominal Catch (t)	175.2	167.9	231.2	203	149.7	123[b]

[a] TACs have not been set on all fisheries
[b] preliminary

Gaspereau

The gaspereau fishery exploits two species, alewife and blueback herring. The largest fisheries are located in or near the Miramichi and Margaree rivers. Yields has been declining in recent years, although the reason is uncertain since there is inadequate biological information on these species. There is interest to initiate fisheries in other river systems.

Miramichi

Year	1979	1980	1981	1982	1983	1984
Nominal Catch (t)	3343	3767	1410	1278	1088	657[a]

[a] Preliminary

Margaree

Year	1979	1980	1981	1982	1983	1984
Landings (t)	1890	1979	1430	1506	724	1043[a]

[a]Preliminary

Eel

There are a number of small eel fisheries which are prosecuted mainly in the Gulf of St. Lawrence. Nominal catches in recent years have been as follows:

Year	1979	1980	1981	1982	1983
Nominal catch (t)	20	70	28	21	9[a]

[a]Preliminary

Other Anadromous-Catadromous Species

Species included here are; sturgeon, shad, smelt, and striped bass which enter freshwater river systems for spawning. While individual daily catches for these species are normally small, the annual catches collectively approach 2,000 t, down from 3,400 t in 1980.

Logbook systems are slowly being introduced in order to improve the catch statistics. Catches of these species are influenced to a considerable degree by fluctuating market conditions. The general trend in catches is not expected to change markedly unless marketing opportunities expand greatly.

INVERTEBRATES

Lobsters: General

The landings in Canada for 1982 of 22,800 t were 5% greater than those of 1981, and continued the upward trend experienced during the late 1970's. The landings increased further in 1983 to a total of 27,600 t. Above-average recruitment in some areas, enhanced by generally excellent fishing weather, was a major factor, while buoyant prices and localized, but effective special protection programs were minor factors in the 1980 landings.

Despite the introduction of regulatory measures in the late 1960's, which limited the number of licences and the number of traps fished per boat in all Atlantic lobster fisheries, there has not been a resultant decrease in fishing pressure in any area; indeed, fishing pressure has probably increased in some areas. The licence buy-back program may lead to a reduction in levels of fishing mortality. A high rate of fishing makes the catch almost entirely dependent on the strength of the newly recruited year-class, leading to greater annual fluctuations in landings. It also makes it difficult to predict catches much in advance of the fishing season.

National and international assessments of Atlantic lobster fisheries indicate that increases in minimum legal size and rates of removal not exceeding 30 per cent to 50 per cent per year are required to maximize yield per recruit. In several inshore lobster fisheries, rates of removal of 80 per cent to 90 per cent per annum have been documented, while size limits are at or below the size at which most females mature. This combination must eventually lead to major stock declines, such as those which have already occurred in certain areas of the Maritimes. Egg production can be increased substantially by increasing the size limit and/or by reducing exploitation rates. Historical levels of landings indicate that lobster habitat is capable of carrying a substantially higher level of lobster abundance than it does at the present time. Consequently, increased egg production is likely to translate into increased recruitment to the stock. In addition a better quality of landings may be obtained by increasing legal sizes and by modifying some seasons and district boundaries. Research on these issues is underway.

Lobsters: Nova Scotia

Lobsters: Southeast Coast (Districts 5, 5A, 6A, 7A)

Landings in this area have risen 87 per cent between 1980 and 1982 from the all-time low of 141t in 1978. Although this is a very significant increase in landings, it is too early to state that a full-scale recovery to pre-1970 levels will occur. Approximately, 50 per cent of the licences have been retired in this area since 1978. However, recent assessment work indicates that long-term sustained recovery will require a minimum legal size of 89-95 mm (3.5-3.75 inches) carapace length. Recent catches have been as follows:

Year	1979	1980	1981	1982	1983	1984
Catch (t)	157	148	281	263	300	350[a]

[a] Estimate based on catch trends.

Lobsters: Bay of Fundy, Southwest Nova Scotia (District 4A), and Offshore (NAFO Divisions 4X and 5Ze)

Fisheries in these areas are dependent on several major lobster concentrations. The main fisheries are: 1) Grand Manan (Lobster District 2), with recent landings around 409 t; 2) southwestern Nova Scotia inshore fishery (Lobster District 4), with landings of 4,535 t in 1982; and 3) since 1971, an offshore fishery beyond 50 miles from the southwestern Nova Scotia mainland (Browns Bank area and northeast Georges Bank), with landings levelling off at 461 t in 1982. The diverse nature of the various fisheries and uncertain interrelationships between lobsters of the several areas make yields from this region difficult to forecast.

In the Bay of Fundy, 1982 landings were around 235 t for Lobster District 2 and 143 t for Lobster District 3, all above the 30-year means for each district. The good landings in the Bay of Fundy are in part due to a continuing number of large mature lobsters being caught on the New Brunswick side of the Bay of Fundy and in deep waters off Grand Manan. If these constitute a brood stock for the Bay of Fundy, then future reductions in landings could result, especially if fishing effort for these large lobsters spreads to other parts of the Bay.

In Southwest Nova Scotia (District 4A), landings have been relatively stable at around 4,000 t since the late 1940's. The high fishing effort and a minimum size which is below the minimum size of female maturity, results in the removal of most females before they have a chance to reproduce. The problem is compounded by increased effort further from shore in previously unexploited areas which may have acted as refugia for brood stock.

The offshore lobster fishery west and southeast of Browns Bank showed relatively constant landings between 350-383 t since the 408 t quota was introduced in 1977. CPUE (kg/trap haul) has remained constant or increased over this same period. The fishery on northeast Georges Bank peaked in 1978 with 303 t but has since declined to pre-1977 levels. CPUE has remained high;

but increased vessel age, changing fishing patterns, and increased U.S. competition for grounds have reduced overall Canadian effort. The cause of a sudden decline in landings and CPUE in all areas in 1982 has not yet been determined, but environmental conditions and resulting changes in distribution and catchability are possible causes.

Landings for 1984-85 cannot be projected accurately since vessel number, size, and fishing areas are changing; U.S. competition for grounds on Georges Bank is increasing and the natural variation in stock size and availability is unknown. Additionally, although the boundary dispute has been settled, the impact on catch potential cannot be totally evaluated at this time.

Offshore Catch - 1978 to 1984 (NAFO Divisions 4X and 5Ze)

Year	1978	1979	1980	1981	1982	1983	1984
			4X				
TAC (t)	408	408	408	408	408	408	408
Nominal Catch (t)	381	373	350	383	272	330	305[a]
			5Ze				
TAC (t)	-	-	-	N/A	-	-	-
Nominal Catch (t)	303	236	190	192	174	175	180[a]

[a] Estimate based on catch trends.

Lobsters: Southern Gulf of St. Lawrence (Districts 7B, 7B1, 7C and 8).

The 1983 landings of 14,900 t exceeded the 1982 landings by 20% and continued the trend of increasing catches which commenced in 1975. In most areas, catches of both the larger "market" lobsters and the smaller "canner" lobsters have increased proportionally. The previously depressed central Northumberland Strait area has experienced dramatic increases in landings in 1982 and 1983 signaling a partial recovery in this area.

Lobsters: Newfoundland

Compared to the dramatic fluctuations in landings which occurred during the early years of the Newfoundland lobster fishery, landings since 1949 have been relatively stable. From a high of 2495 t in 1955 landings declined to 1245 t in 1972 which was the lowest level of landings since 1945. Between 1972 and 1979 landings increased dramatically to 2590 t which was the highest level of landings since 1912. Landings dropped to 2452 t in 1980, to 2376 t in 1981, and to 2011 t in 1982. Preliminary data indicate there was a moderate increase (to at least 2360 t) in 1983.

Up until 1976, effort, in terms of both licences and the number of traps that could be fished per licence, was uncontrolled. As indicated by fishermen when stating on their licence applications the number of traps that they intended to fish each year, effort increased dramatically after 1955. The limited entry licencing policy was implemented in 1976 and fishermen who were issued licences were restricted to the number of traps they had stated on their 1975 licence application. While the number of licenses issued has dropped from 5410 in 1976 to 4160 in 1982, the number of traps allowed has increased substantially over the 1976 to 1982 period (in 1982, 638,366).

The increased landings during the 1970's resulted, at least in part, from increased recruitment. Recent analyses of the time series of data that has accumulated from ongoing studies of lobster population dynamics in the Comfort Cove, Notre Dame Bay area have shown that in this area, despite very high exploitation rates, recruitment increased substantially over the 1972 to 1978 period. The cause of this increased recruitment cannot be determined with certainty. Environmental conditions for survival of larvae to settlement or for survival and growth of postlarval and early juvenile stages may have been much better than average during the mid to late 1960's. Another possibility is improved conditions (eg. reduced competition) for growth and survival of early juveniles and prerecruits because of low levels of abundance of older animals, as indicated by commercial landings, during the early 1970's.

How widespread the increased recruitment was during the 1970's is not known. Substantial increases in landings occurred in Notre Dame, Bonavista, Placentia, and Fortune Bays and along the southwest coast, but there is no way to determine how much of the increase was due to increased recruitment and how much was due to increased effort.

Currently, exploitation rates in the Newfoundland lobster fishery are in excess of 80 per cent. In any fishery that is so heavily dependent on recruitment, slight variation in recruitment can result in substantial fluctuations in landings from year to year.

Yields from the Newfoundland lobster resource could be sustained at levels in excess of 1979 landings (2586 t) if the proper measures are taken. However, if current conditions continue, all that can be expected over the long-term is a downward trend.

Ten lobster management areas have been established for Newfoundland and the Newfoundland Lobster Advisory Committee has recommended a trap limit and a total allowable level of effort (traps in use) that would have the number of licences reduced to 2,124 and the number of traps reduced to 420,000 for the Island as a whole. Also recommended is an increase in size limit from 3 3/16" to 3 1/2" carapace length. Future landings will depend on whether or not these recommendations are implemented and enforced.

Lobsters: Québec

Lobster landings in Québec in the early 1900's were as high as 2,500 t but declined to 839 t by 1942. Subsequently, landings increased to 2,000 t in 1962 but declined to 1,000 t in 1973. Recently landings have increased, as follows

Year	1979	1980	1981	1982	1983
Catch ('000 t)	1.9	1.6	1.8	1.7	2.1[a]

[a] Preliminary

Shrimp: General

The commercial exploitation of shrimp (mainly *P. borealis*) by Canada on the Atlantic coast started in the mid-sixties. Landings increased in the first few years of the fishery from less than 1,000 t to 5,000 t in 1975. These increased landings continued during the mid- to late-seventies, reaching 11,000-13,000 t in the 1978-83 period. Future catch levels will depend, in part, on the economics of harvesting operations.

Shrimp: Gulf of St. Lawrence (4RST)

There are five fisheries areas for shrimp in the Gulf on which advice is provided. Since 1982, the target annual exploitation rate of these has been set at 35%. Research surveys have indicated that the area north of Anticosti Island and the Esquiman Channel area could support additional fishing pressure but future catch levels in these areas will depend on the strength of the incoming year-classes and on the economics of harvesting operations.

In the Sept-Iles Area (west 4S) landings have varied between 3,000 t and 3,600 t since 1979. The overall quota was set at 3,300 t for 1983 and for 1984. This overall quota was adjusted upward by 500 t in the fall of 1984. The stock biomass estimates have been relatively stable in this area over the last few years.

In the North of Anticosti Island Area (north-east of 4S), the catch doubled in 1982, but represented only 57 per cent of the quota. The catch increased further in 1983, when it reached 2,925 t. The potential yield was estimated at 5,800 t, according to the surveys conducted in 1980-82.

In the south of Anticosti Island Area only marginal fishing takes place. Landings fluctuated between 12 t and 384 t in the 1978-1982 period. A precautionary TAC of 500 t was adopted for this area in 1983 and 1984 but the future may change depending on recruitment and relative efforts.

In the Estuary Area (4T), sustained fishing in this zone seems less likely, because of the low shrimp density observed during the last survey, in 1982.

The Esquiman Channel Area (north and south) (4R) has been managed as an entity since 1982. Based on the last research surveys, potential yield is expected to be about 7,000-8,000 t. Esquiman Channel is exploited chiefly by the Newfoundland fleet which operated essentially in the northern part of the area. Catches of 2,250 t in 1983 correspond to 37% of the quota recommended for that year. Before 1981, the fishery was directed essentially at shrimp, but in the last few years, the effort has been divided between cod and shrimp. The fishing pressure on shrimp can thus change from one year to the next.

Catch ('000 t)

Stock	1979	1980	1981	1982	1983	1984
Sept-Iles	3.2	2.9	3.3	3.6	3.4	3.6[a]
North of Anticosti	1.1	1.5	1.4	2.5	2.9	1.2[b]
South of Anticosti	0.01	0.06	0.4	0.2	0.3	0.7[a]
Estuary		0.5	0.3	0.2	0.2	0.2[a]
Esquiman	3.2	2.4	3.0	2.1	2.2	0.5[b]

[a] Preliminary
[b] Statistics are incomplete

Shrimp: Nova Scotian Shelf (4VWX)

Shrimp exploitation on the Scotian Shelf is concentrated in the Canso, Louisbourg, and Misaine Holes off Cape Breton Island. The fishery began in 1977 and landings peaked in 1980 at nearly 1,000 t. The number of licences has been expanded in 1983 and increased effort should yield higher catches. However, the stock remains under-exploited with potential yields currently estimated to be of the order to 5,000 t.

Research catch rates were higher in 1983 which suggests an improvement in recruitment.

Due to the very low effort to date and the changing number of licences, catches cannot be predicted for the stock.

Catch - 1978 to 1984 (NAFO Subaras 4VWX)

Year	1979	1980	1981	1982	1983
Catch ('000 t)	0.8	1.0	0.5	0.6	1.0[a]

[a] Preliminary

Shrimp: Ungava Bay, Eastern Hudson Strait, and Baffin Island

Research surveys and some exploratory fishing have indicated commercial concentrations of the striped pink shrimp (Pandalus montagui) in the Hudson Strait west of Resolution Island. A TAC of 750 t was proposed for 1983. A precautionary TAC of 100 t was advised for a less productive area in Ungava Bay and another 100 t for all remaining unexplored areas. Sustainable levels of fishing have not yet been determined.

Baffin Island (Subarea 0) west of the large northern international fishery (Subarea 0+1) has shown little potential in terms of commercial concentrations; low catch rates rather than low biomass is the main reason.

Shrimp: Davis Strait

In the international fishery along the Greenland coast, a TAC of 29,500 t was advised for 1983 and 1984. Based on an estimate of 17% of the resource in the Canadian zone, Canada's allocation was 5,000 t. Similar allocations can be expected in the short-term and catches may fluctuate between 2,500 and 5,000 t depending on distribution of fishing effort. Recent nominal catches and TACs have been as follows:

Year	1979	1980	1981	1982	1983	1984
Canadian TAC ('000 t)	2.0	2.5	5.0	5.0	5.0	5.0
Nominal Catches ('000 t)	1.7	2.7	4.5	2.7	4.0[a]	-

[a]Preliminary

Shrimp: Labrador (SA2)

Estimates of minimum trawlable biomass and biological data from research surveys were used along with data on fleet performance to provide the basis for TAC's totalling 6,650 t in 1983. Included in the total, however, are some historically, unproductive areas such as Div. 2G, Div. 3K, and Hawke Channel.

No long-term forecasts can yet be made, but indications of a decline in the resource in the Cartwright Channel have become evident despite a substantial decline in fishing effort. Although recruitment and stock sustainability remain uncertain, catches in the short-term should continue in the order of 2,000-4,000 t depending on distribution of effort (eg. Labrador vs Davis Strait). Most of the catch will be taken from the Hopedale Channel. TACs and nominal catches for recent years have been as follows:

Year	1979	1980	1981	1982	1983	1984
TAC ('000 t)	6.7	6.65	6.65	6.65	6.65	5.05
Catch ('000 t)	3.7	4.1	3.6	1.9	1.1[a]	3.2[a]

[a] Preliminary

Snow Crab: General

Between 1975 and 1983, the landings of snow crab in Atlantic Canada increased by at least a factor of seven, reaching a peak in 1982. This upward trend was the result of a number of factors, including good recruitment, expansion of fishing effort and expansion of exploitation to new grounds. Most snow crab concentrations of commercial importance are now exploited at, or beyond, the target levels. In the mid-term, total landings are likely to increase further but are expected to fluctuate in response to the natural variations in recruitment.

Snow Crab - Estuary and North Shore

The exploitation of snow crab in the Estuary and on the North Shore experiences three distinct phases. At the end of the 1960's, some offshore vessels from the Gaspé Peninsula and from New Brunswick landed up to 1,100 t in the Port-Cartier area. Between 1971 and 1977, the offshore vessels moved to other fishing grounds in the Gulf and landings on the North Shore declined. Since 1978, a gradual increase of fishing effort has taken place, with corresponding increases in catch:

Year	1978	1979	1980	1981	1982	1983	1984
Catch ('000 t)	0.2	0.6	1.6	1.8	3.0	3.8	4.9[a]

[a] Preliminary

The management strategy adopted in recent years allowed this expansion of fishing effort and a good distribution of fishing pressure over the whole area. As this fishery is still young, it is too early to tell if the landing levels reached in 1984 will be sustainable.

Snow Crab: Southwest Gulf (4T)

This fishery began in 1966, catches expanding rapidly to 7,600 t in 1969 and then fluctuating within the range of 4,600 t to 7,600 t until 1977 when they increased to 9,500 t. Landings increased further to about 15,000 t in 1979 and 1980. The increase was accompanied by an increase in fishing effort and an increase in catch rate. Recent nominal catches have been as follows:

Year	1979	1980	1981	1982	1983	1984
Nominal Catch ('000 t)	16	15	20	28	24	26[a]

[a] Preliminary

Since 1978, the upward trend of snow crab landings in the south west area of the Gulf reflects an intensification of the real fishing effort and an apparent increase of performance per trap fished. Up to 1982, the stock benefitted from an excellent recruitment period. The number of crabs increased, and their average size decreased. Since 1982, there seems to be a reduction in the number of new recruits. It appears that real performance (CPUE) has decreased. If the stock continues to be heavily fished, the landings will fluctuate depending on the success of recruitment.

Snow Crab: West Coast of Cape Breton Island (Areas 1 and 7)

The management of snow crab in Area 1 is based on the observation that the production from this stock seems to have been stable. Improved data and assessment methods suggested that the real fishing level is less than what was anticipated for 1983, thus the 1984 TAC was increased to 1,400 t. If the resource remains stable, we can expect sustained landings of 1400 t per year. Recent TACs and nominal catch have been as follows:

Year	1979	1980	1981	1982	1983	1984
TAC ('000 t)						
Area 1	1.4	0.8	1.0[1]	1.0	1.0	1.4[3]
Nominal Catch ('000 t)						
Area 1	1.4	1.1	0.8	1.0[2]	1.0[2]	1.4[3]
Area 7	0.2	0.5	0.5	0.8	0.8	0.7[3]

[1] Revised to 699 t during the fishing season

[2] Catch of approximately 300 t not included in statistics should be added to these numbers.

[3] Preliminary

The fisheries in Area 7 started on an exploratory basis in 1979. Fishing effort is distributed just south of the boundary line between areas 1 and 7. This suggests that fishermen from areas 1 and 7 are sharing the same stock. Recent analyses indicate an exploitation date of 45% for this area and that annual catch rates have been stable. Future catch levels are unlikely to exceed recent levels in the short term.

Snow Crab: Atlantic Coast of Cape Breton Island (Areas 2-6)

This fishery is based on a resource which has a low and sporadic productivity that cannot be meaningfully managed by TAC controls. The accumulated virgin biomass has been almost entirely removed and fishermen harvest whatever scanty recruitment occurs annually. Catches have averaged 400 t per annum since 1980, and low catch levels are expected to continue into the foreseeable future.

Year	1979	1980	1981	1982	1983	1984
Catch ('000 t)	1.6	0.8	0.2	0.6	0.3	0.1[a]

[a] Preliminary

Snow Crab: Eastern Newfoundland and Labrador

This fishery began in 1968 and underwent development at a moderate pace until 1978 when, due to increased market demand, landings increased yearly, reaching a peak in 1981 and 1982 at approximately 13,000-14,000:

	Catch ('000 t)					
Year	1979	1980	1981	1982	1983	1984
Southern Zone	10.3	8.8	13.0	10.7	6.2	3.8[a]
Northern Zone	0.8	0.6	1.2	2.5	4.9	4.6[a]
Total	11.1	9.4	14.2	13.2	11.1	8.4[a]

[a] Preliminary

Although this increase in landings is a reflection of increased harvesting and processing capacity within the industry, it is also directly related to the discovery and exploitation of new crab resources in the area 60-100 nautical miles east of the Avalon Peninsula. It is noteworthy that these new fishing grounds were only exploited after the catch became so low in traditionally fished areas as to make fishing uneconomical.

Exploratory surveys have located significant snow crab resources in previously unexploited areas in the northeastern portion of the Province. As a result, nine snow crab fishing permits were issued for these areas in 1983. This brought the total number of vessels fishing snow crab in Newfoundland to 60.

Assessments which have been conducted for almost all commercial fishing areas since 1979 show that exploitation rates in traditionally fished areas have risen from a 40-50% level to levels exceeding 70% in many areas and 80% in Bonavista Bay. These high exploitation rates have resulted in such low catch rates in areas such as Bonavista and Conception Bays that fishermen were forced to move to other areas. Another result of overfishing in these areas has been a high incidence of soft-shelled (newly moulted) animals in the catch during an inordinately long part of the fishing season.

Although the fishing area continued to expand during the 1983 fishing season, catch rates have dropped in both heavily exploited, traditionally fished areas, and in those areas that were recently discovered and have only been moderately exploited. Reasons for this drop in CPUE are not readily apparent. However, water temperatures on the commercial fishing grounds were quite low and fishermen reported large numbers of dead capelin (-1.5°C) on the bottom which may have affected snow crab catchability in these areas. Crab landings for 1983 decreased to about 11,000 t.

Since the fishery is still expanding, it is difficult to attempt to forecast the long-term viability of this fishery. It must be fully recognized, however, that in those areas where there has been sustained high exploitation rates, the commercial fishery has suffered from reduced catch rates as well as quality problems. The nature of the fishery is such that vessels fish localized crab concentrations, and then move to other areas as catches drop off. The viability of this fishery is largely dependent on the mobility of the fleet and the ability of heavily fished crab populations to recover. Assuming that 1984 was an exceptionally poor year with regard to landings, catches should range from 8-15,000 t annually.

Other Crabs

Rock crab (*Cancer irroratus*) harvesting continued at a low level approximately 200 t in 1983, mainly as a bycatch to the lobster fishery. Most landings are in Northumberland Strait, although small catches occur in southwest Nova Scotia and the Bay of Fundy. The resource, although unquantified, should be able to sustain a considerable expansion of the fishery if the economics of processing and marketing the product improves.

Initiation of a directed fishery for Jonah crab (*Cancer borealis*) off southern and southwest Nova Scotia in 1983 and 1984, has resulted in landings of approximately 100 t. Previous landings, largely as a bycatch to the lobster fishery, had been small and sporadic due to lack of marketing structure. The development of a sustained fishery on this under-exploited resource appears to depend mainly on improvements in processing capability. There have been no assessments of the potential yield of the crab on the southern Scotian Shelf.

Surveys for deep-sea red crab (*Geryon quinquedens*) conducted in 1980 and 1981 over the 5,500 km^2 area between the 200 m and 800 m contours from the Fundian Channel to the Gully have assessed the total trappable biomass as 3,500 t. Assuming a fishery for red crab in excess of 115 mm carapace width, approximately 30 per cent of the total trappable biomass would be excluded. No reliable appreciation of the sustainable yield from the resource is available but it should initially be considered as being no higher than 10 percent. Pilot commercial fishing for red crab on the Scotian Shelf was carried out in 1983.

Sea Scallops: General

Canadian scallop landings during 1983 continued the decline experienced in 1982. Total landings are down about 25 percent from 1982, and are down about 50 per cent from 1981. Declining catch of scallops from Georges Bank is the major cause of these declines, the catch from the Bank being itself down 60 per cent from 1981. So far the industry has maintained viability due to increased market price (about double that of a year ago) and incidental catches from secondary production areas such as the Scotian Shelf and St. Pierre Bank.

The outlook for early 1985 is not encouraging; the forecast for Georges Bank is for yet further declines in production. The chief reason prospects appear poor is that the resource currently is returning to a more normal level of recruitment. This situation follows several years of high catches generated primarily from the extremely successful year-class of 1972, and secondarily from the above-average year classes of 1977 and 1978. Added to this, is that high effort levels attracted to the fishery by the high catches, resulted in a cropping down of the population until essentially one age class supported catches. This was further exacerbated by the removal of meat size controls during late 1981 to early 1982 in the face of the unrestricted effort of United States fishermen. Small scallops caught then are not there to help sustain the fishery at a time of average or below-average recruitment during the 1983-85 period. The new year-class that will enter the fishery in late 1985 does, however, appear to be somewhat stronger than its immediate predecessors.

Secondary areas can be expected to replace only a fraction of the overall decline in catches from Georges Bank, and there is no basis upon which further price increases may be forecasted as was the case last year.

Sea Scallops: Georges Bank (5Ze)

Landings by Canadian fishermen continue to decline after a short-term increase in 1981 (1979: 9,207 t meats; 1980: 5,221 t; 1981: 8,013 t; 1982: 4,306 t; 1983: 2751 t). More than a decade of high fishing mortality has depleted the standing stock of scallops in Div. 5Ze. Such fishing effort increases the dependence of the fishery on each year's recruitment, which has been good since 1977, but not good enough to sustain the high effort levels of recent year. Recruitment prospects, based on 1983 research surveys, indicate below average recruitment in 1984. The long-term forecast is for continued reduced landings, but the rate of catch decline will be reduced over the near future. Recent landings have been as follows:

Year	1979	1980	1981	1982	1983
Catch ('000 t of meats)	15.6	10.7	16.5	10.4	6.3[a]

[a] Preliminary

Sea Scallops: Bay of Fundy and Southwest Scotian Shelf (4X)

Landings have fluctuated above historical levels since 1980 in both inshore and offshore areas. Above-average recruitment of the 1973-74 year classes has been responsible for these increased landings. There are indications that these year-classes are now being depleted and landings should decline in the near future.

Year	1979	1980	1981	1982	1983
Catch ('000 t of meats)	1.0	2.3	2.1	2.1	1.5[a]

[a] Preliminary

Sea Scallops: Eastern Scotian Shelf (4VW)

Reduced catch rates on Georges Bank have led to the exploitation of scallop beds which had not been fished for a decade. Little is known of the yield profile of the Eastern Scotian Shelf concentrations.

Sea Scallops: Southwest New Brunswick - Grand Manan

Landings in 1983 were 338 t. Scallops have cyclic periods of abundance. Prospects are for good landings until the current excellent year-classes pass through the fishery. Unless further beds are found, landings should tail off by 1984. The estimated sustainable yield is not available for this stock. Recent catches have been as follows:

Year	1979	1980	1981	1982	1983
Catch (t of meats)	30.1	164.0	561.5	294.0	338[a]

[a] Preliminary

Sea Scallops: Southern Gulf (4T)

Recent Northumberland Strait scallop landings have been at a relatively low level (211 t in 1980, 355 t in 1981, 266 t in 1982, and 333 t in 1983). Preliminary statistics for 1984 indicate landings of 220 t for this area. No evidence of above average recruitment was found in most areas. Heavily fished areas like the eastern part of lobster district 8 experienced very low recruitment in recent years. The pattern of recruitment in the Northumberland Strait and adjacent area remains unknown and it is impossible to say now if stocks are self-renewed or depending on parent stock in other areas for recruitment. For lobster districts 8 and 7bl, long term prospects are not too encouraging due to erratic recruitment and heavy fishing pressure. Lobster district 7c, although it does not show an outstanding resource, seems to have steady recruitment insuring a normal stock renewal and stable levels of exploitation if fishing effort remains at its present level.

Sea Scallops: Newfoundland (3Ps)

The offshore scallop beds on St. Pierre Bank are prosecuted exclusively by Maritime-based offshore vessels which make intermittent, opportunistic excursions to buffer declining catches elsewhere on the Atlantic seaboard. An unprecedented diversion of effort into St. Pierre Bank in 1982 resulted in record removals of approximately 700 t meats. Continued effort in this area resulted in further removals of 600 t (preliminary estimate) in 1983 with continued reductions in the short-term. St. Pierre Bank is unique in that two species of scallops are often found mixed together in small areas which yield attractive catch rates. Historically, fleets operating in this area have had a decided preference for sea scallops but larger Iceland scallops are now being increasingly retained. Their relative contributions are highly variable and impose unique problems to species-specific management. Catches are expected to fluctuate depending on effort, and strength of recruitment.

Year	1979	1980	1981	1982	1983
Catch (t meats)	1	35	-	700	600[a]

[a] Preliminary

Iceland Scallops: Strait of Belle Isle

A fishery for the Iceland scallop developed in the northeastern Gulf in 1969. The fishery is prosecuted in an area covering approximately 260 square kilometers west and northwest of Anchor Point, Newfoundland. Annual landings during the first six years of the fishery ranged from 151 t in 1971 to 2,342 t in 1972 with a mean of 844 t. In 1973, catches were still relatively high (1,975 t) when scallopers began to switch to trawling shrimp as the latter became more attractive both in terms of abundance and prices. There was no active fishery for the mollusc between 1975 and 1978. The fishery resumed in 1979 when 406 t were taken. Landings increased to 1,400 t in 1981, but decreased to 315 t in 1982. In 1983 and 1984, landings reached 340 t and 600 t respectively.

Between 1981 and 1984, the fishery experienced changes in fishing patterns. Up to 1981, almost all the fishing effort was concentrated in a triangle Anchor-Point/Blanc Sablon/New Ferolle Point but since 1981, effort was gradually moved to north-eastern zones. The effort expanded in the Strait of Belle Isle has not yet resulted in an appreciable drop in catch rate. However, as the fishery is still relatively new, the impact of the present fleet needs further monitoring.

Squid: Canadian Atlantic (2-4)

Short-finned squid (Illex) is the major commercial cephalopod species in Canadian Atlantic waters. The Arctic squid (Gonatus) usually found in Newfoundland-Labrador waters (SA 2+3) and the long-finned squid (Loligo) found in southern Scotian Shelf waters (SA4) are sometimes taken as bycatch in other fisheries. In recent years (1976-78) increased catches of Illex both offshore and inshore (SA 3+4) were due to both increased abundance and increased fishing in response to foreign market demand. Catches of Illex fluctuated widely in the inshore domestic fishery, ranging from less than 100 t to 11,300 t prior to 1977. The inshore landings, primarily in Newfoundland (SA3) increased dramatically in 1977 and reached 89,000 t in 1979. A substantial foreign offshore trawl fishery developed in the 1970's (primarily in SA4) with catches of 30,500 t in 1976; 49,300 t in 1977; and 60,000 t in 1978.

In SA 3+4, a TAC was in effect during 1975-77, which allocated 10,000 t to Canada and 15,000 t to the U.S.S.R., while permitting other countries to take up to 3,000 t annually. TACs of 100,000 t in 1978; 120,000 t in 1979; and 150,000 t from 1980 to 1982, were set with a restriction on fishing effort for the offshore fishery to guard against overfishing if abundance declined.

Subarea 4 catches have dropped from a high of 71,279 t in 1979 to a low of 1,635 t (total international and domestic) in 1982. Present trends indicate that 1984 catches will remain low.

Since 1979, the yearly inshore resource level of squid at Newfoundland (SA3) has declined steadily, as reflected in a pronounced decline in catch. Recent TACs for Subarea 2-4 and nominal catches have been as follows:

Year	1979	1980	1981	1982	1983	1984	1985
			Subarea 3 and 4				
TAC ('000 t)	120	150	150	150	150	150	150
			Subarea 3				
Nominal Catch ('000 t)	160	67.9	31.6	12.5	0.0[a]		

[a]Not available at the time

Extreme fluctuations in yearly availability of the resource is likely related to the short life cycle of short-finned squid (approximately one year) and hence, the dependence of this fishery on a single year-class. Such fluctuations appear to be non-cyclic and may be related to variation in actual population size or distribution pattern in relation to environmental conditions. Thus, resource prospects for future years cannot be anticipated. Historical trends indicate that years of a very low resource level frequently occur in succession. However, such a low level may also be succeeded by a year of high resource abundance.

Oysters:

The New Brunswick landings reached 378 t in 1982. Caraquet Bay is the largest, oyster producing area of the province. Increasing oyster populations combined with increased activity in the private lease sector should result in steadily increasing landings which may exceed 800 t by 1990.

The Northumberland Strait shore of Nova Scotia, produces 20 to 30 t of oysters per year. Production activities here are limited by spat shortage and landings are not expected to increase substantially to 1990.

With catches of about 1,100 t per year, Prince Edward Island is the major oyster producer in Atlantic Canada. A drop in landings in 1982 to about 900 t appears to have been primarily the result of a fluctuation in harvesting effort. Oyster populations in general appear to be increasing even though the 1983 spat fall was very poor. Landings are expected to increase steadily until 1990, as a result of increased fishing effort.

Nova Scotia native oyster production from wild stocks is limited to Cape Breton Island. No increase is projected for the next several years. Recent landings have been as follows:

Year	1978	1979	1980	1981	1982	1983	1984
Catch (t)	32	56	71	77	41	41	41[a]

[a] Estimate based on catch trends.

Clams.

In 1983, Nova Scotia reported landings of soft-shell clams amounted to 2,015 t compared to 1,300 t in 1973. The landings over the years 1972 to 1979 were between 900 t and 1,500 t. In 1980 and 1981 production was 2,141 t and 2,145 t respectively. The increase in the last few years was due to increased fishing pressure and increased market value. Production in the next several years is likely to stabilize at 2,000 t to 3,000 t annually.

From 1974 to 1981, annual soft-shell clam production in New Brunswick ranged from 177 t to 458 t. In 1982, landings increased to 942 t and in 1983 to 1,062. Recent catches for all species on the Atlantic coast have been as follows:

Year	1978	1979	1980	1981	1982	1983
Catch ('000 t)	3.9	3.7	4.3	4.7	6.2	4.9

Other Inshore Molluscs:

Blue mussel aquaculture activities over the past few years should lead to increased production. Only 9 t of cultured mussels were landed in 1982; this may increase to 30 t to 40 t annually by 1985. Increasing hatchery production of European oyster seed and its continual availability to growers will result in production of commercially cultured oysters by 1985. Annual production of European oysters from 1985 to 1987 is likely to be in the range of 5 t to 10 t.

MARINE PLANTS

Irish Moss

The mean annual harvest of Irish moss (Chondrus crispus) [excluding Furcellaria (wireweed) and Gigartina (Fundy moss)] in the Maritimes between 1974 and 1983, was 18,358 wet t. The bulk of this harvest was either raked by hand (southwest Nova Scotia - Marine Plant District 12) or dragraked with inshore boats (southern Gulf of St. Lawrence - Marine Plant Harvesting Districts 1, 2, 6, 7, 8, 9). Harvesters in Districts 1 and 12 have, since 1974, produced 69 percent of the annual Maritime harvest. Total landings in these two districts have ranged between 23,000 wet t (1974), and 11,762 wet t (1981). A marked decrease since 1979 (19,100 wet t) was largely due to a 60 per cent drop in District 12 landings over the pre-1979 average. Although there was some evidence for a reduction in standing crop since 1978, reduced resource accessibility due to fewer extreme low daylight tides and a lower level of effort accounted for this drop in landings. Other fisheries, particularly herring gill netting, attract more Irish moss harvesters as the price for Irish moss has not increased since 1978. Landings for District 12 in 1982 declined to 4,330 wet t but increased to 5,623 wet t for 1983.

The 1982 and 1983 landings in District 1 increased to 7,800 and 8,924 wet t respectively from 6,145 wet t in 1981. This was near the six-year average to 1980. Landings in other Gulf districts have been stable since 1980, with the exception of District 4 where there was a 2,000 wet t decline. The level of effort in District 1 continues to be greater than the optimum for maintaining the stocks.

At the present stable price for Chondrus, the industry is not able to compete directly with Asian material and the demand for Chondrus coming from the Canadian Atlantic Coast depends on the unique character of its carrageenan. The future prospects are poor unless a new market or marketing approach is applied to this industry.

Landings - 1978 to 1984

Year	1978	1979	1980	1981	1982	1983	1984
Gulf (P.E.I., N.B., N.S.):							
Landings ('000 wet t)	18	20	18	16	16	17[a]	17[a]
Southwestern N.S.							
Landings ('000 wet t)	11	8	6	6	4	6[a]	6[a]
TOTAL ('000 wet t)	29	28	24	22	20	23[a]	23[a]

[a] Estimate based on catch trends.

Rockweed and Kelp

Rockweed (Ascophyllum nodosum) harvesting in District 12 has been 20-30 per cent below the annual average since 1979. It is expected that recent stabilization in ownership will allow landings to return to normal and perhaps will reach up to 10,000 wet t.

Kelp (Laminaria longicruris) is an underutilized species which has a potential for sale in foodstuff and phycocolloid extraction markets. It is estimated that a minimum harvest of 10,000 wet t per year could be sustained in southwest Nova Scotia.

Wireweed

Wireweed (Furcellaria lumbricalis) and Irish moss are collected in District 4 as a storm-tossed harvest and sold as a mixture. The mean annual harvest has declined by a factor of two since the early 1970's. In 1982, the sole company purchasing mixture for Furcellaria, ceased operations. However, the P.E.I. Government has purchased the mixture and stockpiled it.

Dulse

Dulse (Palmaria palmata) is hand picked at various sites in the Bay of Fundy, 75 per cent coming from Grand Manan. The annual harvest is approximately 100 dry t and has been stable for a number of years.

MARINE MAMMALS

Harp Seals

A total of 175,000 harp seals were allocated for the Gulf of St. Lawrence and "the Front" (northeast of Newfoundland) in 1983 and 1984. However, the catch in these areas was substantially below the allocation due to poor market conditions and the lack of an offshore hunt of whitecoats. In view of the reduced total catches (including Greenland and the Canadian Arctic) in 1983, the population is predicted to increase. 11,000 seals were included in the TAC as a "northern allowance". The present size of the harp seal population in the northwest Atlantic likely exceeds 2 million animals. Following are TACs and nominal catches for recent years:

Year	1979	1980	1981	1982	1983	1984
TAC (000's)	180	180	183	186[a]	186[a]	186[a]
Catch ('000's)	174[b]	187[b]	205[a]	169[a]	56[a]	30[a]

[a] Not including Greenland
[b] Including provisional estimates for Greenland

Hooded Seals

The TAC for hooded seals at the Front was 12,000 in 1983 (9,000 for Canadian and Norwegian large vessels and 3,000 for Newfoundland landsmen) and 2,340 in 1984. Due to poor market conditions in Europe, large vessels did not participate in the traditional hunt for whitecoat harp or hooded seal pups during 1983 or 1984. The status of hooded seals is not certain. Recent catches off Newfoundland consist mainly of pups (the take of adult females is limited to 5% of the daily kill) while Greenlanders have an unregulated catch of about 5,000 hooded seals (mostly adults) per annum. Results of research to clarify the status of hooded seals off Newfoundland, the relationship of this stock with animals pupping in Davis Strait and the effects of catches at the Front and at Greenland are expected in January 1985. Recent TACs and catches have been as follows:

Year	1979	1980	1981	1982	1983	1984
TAC ('000's)	15.0	15.0	15.0	15.0	12.0	2.34
Catch ('000's)	15.1	13.0	13.7	10.0	0.13	0.23

Whales

Several species of whales occur off the Atlantic coast of Canada. Historically, these have been subjected to sporadic whaling operations, the last episode of Canadian whaling ending when the whaling plants at Blandford, Nova Scotia, and Dildo and Williamsport, Newfoundland, were closed in 1972. The primary species harvested was the fin whale with some sei, minke, and sperm whales taken as well as pilot whales off Newfoundland. Commercial whaling has been prohibited since 1972 in waters under Canadian fisheries jurisdiction.

Tourism must be regarded as a source of revenue from these animals. Whale watching is already popular in Newfoundlnd, in the estuary and along the north shore of the Gulf of St. Lawrence, and in the Bay of Fundy.

Annex I - Definitions of Terms Used

MSY	The Maximum Sustainable Yield of a fish stock is the largest annual harvest in weight which can be removed from the stock year after year while maintaining the stock size.
F_{max}	The rate of fishing mortality for a given method of fishing which maximizes the harvest in weight taken from a single year-class of fish over its entire lifespan.
$F_{0.1}$	The rate of fishing mortality for a given method of fishing for which the marginal increase in catch for a small increase in fishing mortality is one-tenth the marginal increase in catch for the same increase in fishing mortality from a zero level.
$2/3. F_{msy}$	The fishing mortality which will occur when 2/3 of the effort giving the maximum sustainable yield is applied to the stock. $2/3\ F_{msy}$ is used to determine the TAC when catches and effort are the only available statistics for the fisheries. This measurement approximates $F_{0.1}$.
OSY	Optimum Sustainable Yield is the annual harvest in weight which can be taken from the stock year after year while maintaining the stock size and allowing the greatest socio-economic benefit. Inherent in the concept are economic and social as well as biological considerations. The OSY will vary among species, over time, and among areas for a given species.
TAC	Total Allowable Catch is the total permitted catch from a stock in a given year.
Quota	A regulated portion of a TAC as distinct from an allowance or estimated catch.
Nominal Catch	The sum of catches that have been reported. Does not include such catches as unreported discards or unidentified young fish put into fish meal.
Sustainable Yield	The maximum harvest allowable on a given population if it is to maintain its present level over the long-term.

Replacement Yield	The maximum harvest allowable in a given year, if the population level at the year's end is to remain the same as it was in the beginning. In a population in which there is a predominance of juvenile animals, (as in the case of the harp seal) the replacement yield is lower than the sustainable yield. The two values are the same in a population which is in equilibrium.

TABLE 1 - TOTAL CATCHES AND CANADIAN CATCHES OF TRADITIONAL GROUNDFISH FROM 1970 TO 1983
WITH TACS FOR 1984 AND 1985 AND PROJECTED TACS FOR 1986 TO 1990 FOR SUBAREAS 2, 3, AND 4

	1970 CATCH			1972 CATCH			1974 CATCH			1975 CATCH			1976 CATCH			1977 CATCH		
SPECIES	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%
Cod	1,007	260	26	896	216	24	708	156	22	557	152	27	461	190	41	393	233	59
Redfish	204	107	52	264	108	41	219	87	40	196	103	53	154	89	58	113	67	59
Haddock	35	25	71	22	17	74	18	14	78	22	18	83	19	18	93	25	23	92
American Plaice	113	90	79	97	66	68	89	60	68	77	56	72	91	76	86			
Witch	39	17	44	43	19	46	38	16	42	32	10	31	32	16	50			
Greenland Halibut	38	12	42	31	10	32	29	7	24	31	9	31	27	11	43	150	125	83
Yellowtail	31	24	79	41	28	68	26	18	70	25	20	80	11	11	95			
Pollock (4VWX+5)	19	11	56	33	18	54	38	25	66	39	27	68	38	24	63	39	25	65
TOTALS	1,486	546	37	1,427	490	34	1,165	384	33	978	394	40	834	437	52	721	474	66

	1978 CATCH			1979 CATCH			1980 CATCH			1981 CATCH			1982 CATCH			1983 CATCH		
SPECIES	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%	TOTAL	CANADA	%
Cod	390	282	72	523	358	68	493	419	84	528	437	83	584	491	84	583	512	89
Redfish	110	73	66	130	81	62	100	49	49	116	72	62	114	66	58	104	58	56
Haddock	34	32	94	30	29	97	45	43	98	51	50	96	40	39	98	35	34	97
(American Plaice (Witch (Greenland Halibut (Yellowtail	160	135	84	156	144	92	131	127	97	133	122	92	119	106	86	97	85.5	88
Pollock (4VWX+5)	46	27	59	48	31	65	55.5	36	65	59	41	69	53.3	38	72	47	33	70
TOTALS	740	549	74	887	643	73	829	675	81	887	722	81	910.3	740	81	866	722.5	83

Table 1. Continued

SPECIES	1984 TAC TOTAL	 CANADA	 %	1985 TAC TOTAL	 CANADA	 %	TAC 1986	TAC 1987	TAC 1988	TAC 1989	TAC 1990
Cod	624	528	85	635	548	86	664	690	715	733	751
Redfish	198.6	142	72	198.6	140	70	203	203	208	199	196
Haddock	35	35	100	30	23.9	80	29	30	28	28	27
(American Plaice											
(Witch											
(Greenland Halibut	208	189	91	199.5	176.5	88	206.5	206.5	207.5	207.5	207.5
(Yellowtail											
Pollock (4VWX+5)	53	42	79	53	42	79	45	43	42	42	42
TOTAL	1,118.6	936	84	1116.1	930.4	83	1147.5	1172.5	1200.5	1209.5	1223.5

Projected TACs are for all stocks off the Canadian Atlantic coast. They include stocks straddling the outer limit of the Canadian 200-mile zone, Canadian boundaries with the U.S.A. and France, and stocks which lie completely outside the 200-mile limit on the Flemish Cap. The PROJECTIONS ARE NOT INTENDED TO DEFINE ESTIMATES OF THE POTENTIAL CANADIAN CATCH. For further explanation, see text page 3.

Slight differences between some of the individual species catches and overall totals are due to rounding to the nearest thousand ton.

Table 2. Projections 1986-1990, with catches in 1980-1983 and TACs for 1984 and 1985, Subareas 2,3 and 4 (000's metric tons).

SPECIES	AREA	Catch Total	1980 Canada	Catch Total	1981 Canada	Catch Total	1982 Canada	Catch Total	1983 Canada	TAC Total	1984 Canada	TAC Total	1985 Canada	TAC 1986	TAC 1987	TAC 1988	TAC 1989	TAC 1990
Cod	2+3	255.2	194.5	266.6	195.9	321	248	326	267	358	286	373	307	402	411	423	438	457
Cod (1)	4VWX	90	90	98	96	100	99	87	84	99	96.3	101	98	94	99	104	107	110
Cod	4RST (7)	153	134	163	142	163	144	170	161	167	146.5	167	146.5	168	180	188	188	184
Haddock	4VWX	43.7	43.2	50.8	50.0	40	39	35	34	35	35	30	30	29	30	28	28	27
Redfish	2+3	71.4	20.9	77.3	33.4	71	24.8	66	22	118	65	118	63	118	118	118	118	118
Redfish	4VWX	14.1	13.1	19.0	18.0	16.1	14.4	13	12	30	27	30	27	30	30	30	30	30
Redfish	4RST	14.8	14.8	20.5	20.4	26.4	26.4	25	24	50.6	50	50.6	50	55	55	60	51	48
Silver Hake	4VWX	44.5	0.1	41	+	60.2	.04	36	0.3	80	1.0	100	1	70	70	70	70	70
Pollock	4VWX+5	55.5	36.0	59	41	53.3	38	47	33	53	42	53	42	45	43	42	42	42
American Plaice	2+3	58	56	61	58	54	53.4	43	39	72	68.8	66	63	72	72	72	72	72
American Plaice	4T	9	9	8	8	7	7	6	6	10	10	10	10	10	10	10	10	10
Witch	2+3	3	2.9	4	3.6	7.3	3.4	6	3.5	16	10	16	9.5	16	16	16	16	16
Witch	4RS	3	3	1.2	1.2	2	2	0.7	0.7	3.5	3.2	3.5	3.2	3.5	3.5	3.5	3.5	3.5
Yellowtail	2+3	13	12.4	15	14.1	12.7	11.6	9	9	17	16.6	15	14.6	16	16	17	17	17
Greenland Halibut	2+3	33	32	30	24	26	19	22	17	75	66.5	75	63	75	75	75	75	75
Flatfish	2+3	107	103.3	110	99.7	100	87.4	80	68.5	180	161.9	172	150	179	179	180	180	180
Flatfish	4VWX	12	12	13	12.6	10	9.6	10.3	10.3	14	13.8	14	13.7	14	14	14	14	14
Flatfish	4RST	12	12	9.2	9.2	9	9	6.7	6.7	13.5	13.2	13.5	13.2	13.5	13.5	13.5	13.5	13.5

Table 2. Continued.

SPECIES	AREA	Catch Total	1980 Canada	Catch Total	1981 Canada	Catch Total	1982 Canada	Catch Total	1983 Canada	TAC Total	1984 Canada	TAC Total	1985 Canada	TAC 1986	TAC 1987	TAC 1988	TAC 1989	TAC 1990
Roundnose Grenadier	2+3	2	0	7	0	4	0	3.5	0	11	1	11	.5	11	11	11	11	11
Argentine	4VWX	2	0	0.5	0	0.4	0	0.9	+	10	+	10	0	10	10	10	10	10
Other Groundfish (2)	2+3	8	7.1	13.6	4.2	10.1	4.4	12	4.3	16	6	18	8	20	20	20	20	20
Other Groundfish (2)	4VWX	12.6	12.4	12.0	11.6	14.8	9.8	20	12	30	15	40	25	50	50	50	50	50
Other Groundfish (2)	4RST	14.6	14.3	16.3	16.3	10.7	10.7	15	11.2	20	15	25	20	30	30	30	30	30
Groundfish (3)	2+3	443	326	475	333	506	365	488	362	675	594	687	523	729	718	718	766	784
Groundfish (3)	4VWX	274	207	293	229	295	211	331	224	383	242	374	236	342	346	348	351	353
Groundfish (3)	4RST	194	175	209	188	207	188	230	216	251	224	234	230	266	278	292	283	276
Markerel (6)	3+4	25	22	28	19	26	16	25	20	100	45							
Herring (6)	2+3	15.3	15.3	10	10	2.6	2.6	0.7	0.7	1.9	1.9							
Herring (4)	4VWX	113	113	92	92	89	89	87	87	83.5	83.5	94.5	94.5	98.5	98.5	101.5	104.5	104.5
Herring (8)	4RST	60.5	60.5	35.2	35.2	34.6	34.6	34.7	34.7	28	28	31	31	9.7	9.1	8.7	8.4	8.2
Capelin (6)	2+3	23.4	18.6	37	26.4	41	31	39	29	138	121	60						
Capelin	4RST	3.5	3.5	2.4	2.4	0.4	0.4	1	1	30	30	30	30	30	30	30	30	30
Cod Total	2-4	498	419	528	437	584	491	583	512	624	528	636	548	664	690	715	733	751
Haddock Total	2-4	44	43	51	50	40	39	35	34	35	35	25	25	29	30	28	28	27
Redfish Total	2-4	100	49	116	72	114	66	104	58	198.6	142	198.6	140	203	203	208	199	196
Silver Hake Total	2-4	45	0.1	41	0.1	60.2	0.04	36	0.3	80	1	100	1	70	70	70	70	70
Pollock Total	2-5	56	36	59	41	53.3	38	47	33	53	42	50	42	45	43	42	42	42

Table 2. Continued.

SPECIES	AREA	Catch Total	1980 Canada	Catch Total	1981 Canada	Catch Total	1982 Canada	Catch Total	1983 Canada	TAC Total	1984 Canada	TAC Total	1985 Canada	TAC 1986	TAC 1987	TAC 1988	TAC 1989	TAC 1990
Groundfish Total	2-4	911	708	977	750	1008	764	1050	803	1310	1060	1304	995	1338	1343	1359	1401	1414
Herring Total (6)	2-4	189	189	137	137	124	124	141	141	113.4	113.4	125.5	125.5	108	108	110	113	113
Finfish Total (5)	2-4	1152	941	1181	932	1199	935	1257	995	1691	1325	1520	1151	1476	1481	1499	1544	1557

(1) For 1982-1990 includes anticipated catches of inshore cod in 4X not subject to quota
(2) Groundfish species not subject to quota
(3) Includes items (1) + (2) above
(4) Estimates do not include the sardine catch in N.B. weirs which are not subject to quota but do include a catch of 3500 t in 4Vn 1985-1990
(5) Includes (1), (2), (4) and (6) above
(6) In view of extreme uncertainties about recruitment, no projections are given for mackerel, and some stocks of herring and capelin
(7) Cod in 4RST includes catches in P_n and Vn.
(8) Projection for 4R only

Projected TACs are for all stocks off the Canadian Atlantic coast. They include stocks straddling the outer limit of the Canadian 200-mile Canadian zone, boundaries with the U.S.A. and France, and stocks which lie completely outside the 200-mile limit on the Flemish Cap. The PROJECTION ARE NOT INTENDED TO DEFINE ESTIMATES OF THE POTENTIAL CANADIAN CATCH. For further explanation, see text page 3.

MAP ILLUSTRATING NAFO'S CONVENTION AREA AND 200-MILE FISHING ZONE BOUNDARIES

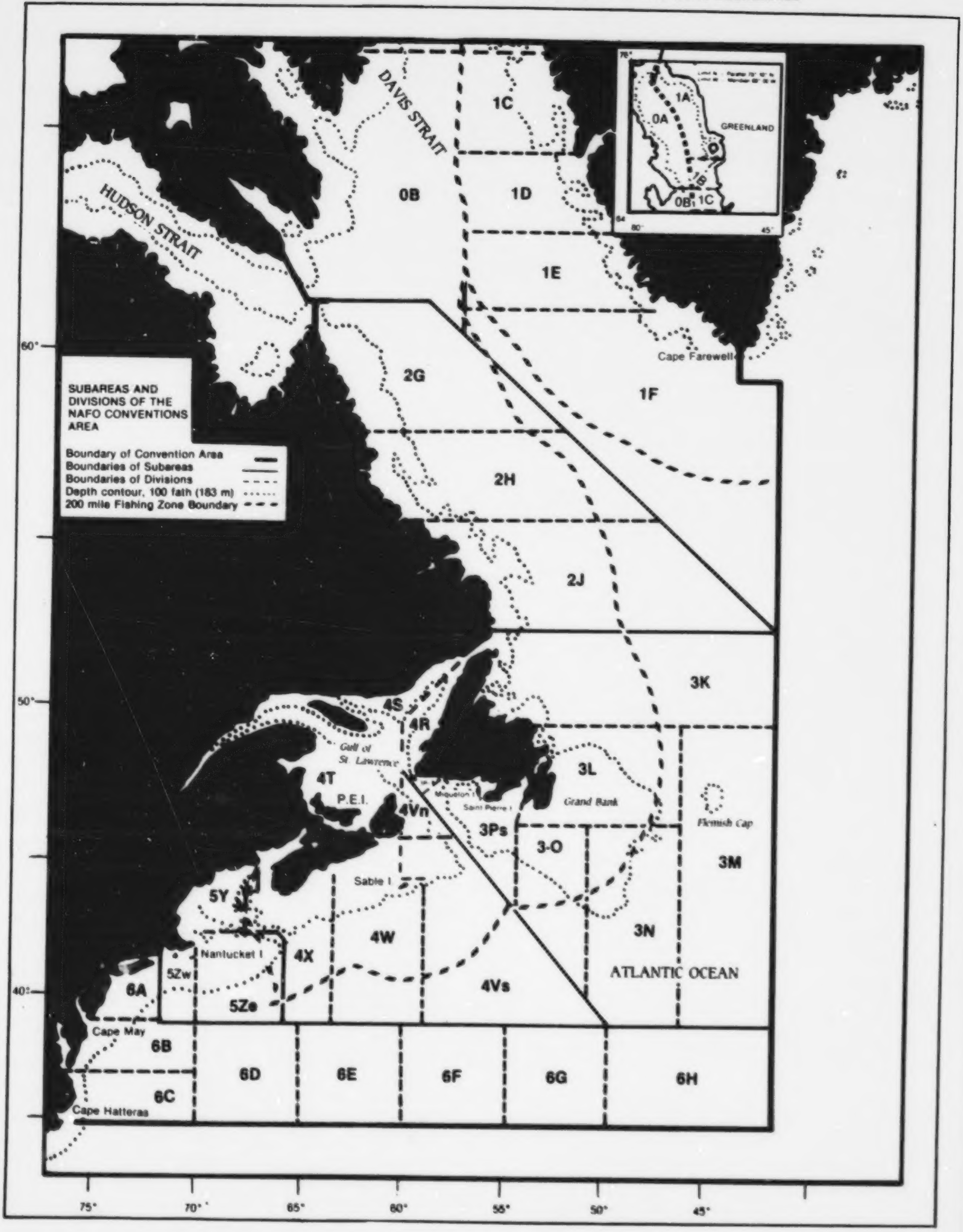


Figure 1

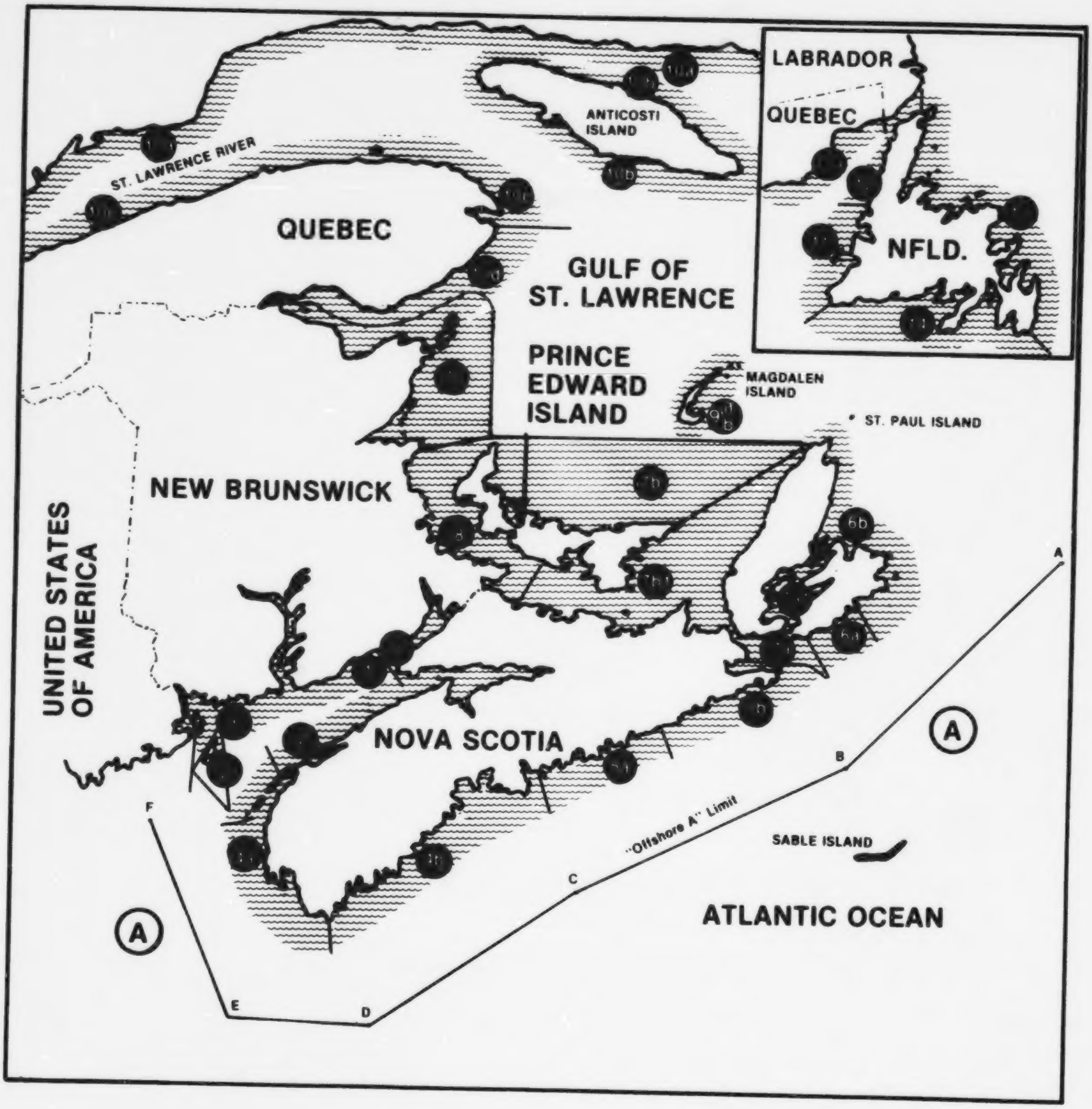

LABRADOR
QUEBEC
NFLD.
ANTICOSTI ISLAND
ST. LAWRENCE RIVER
QUEBEC
GULF OF ST. LAWRENCE
PRINCE EDWARD ISLAND
MAGDALEN ISLAND
ST. PAUL ISLAND
NEW BRUNSWICK
UNITED STATES OF AMERICA
6b
A
A
NOVA SCOTIA
B
"Offshore A" Limit
SABLE ISLAND
C
F
A
ATLANTIC OCEAN
E
D

Figure 2

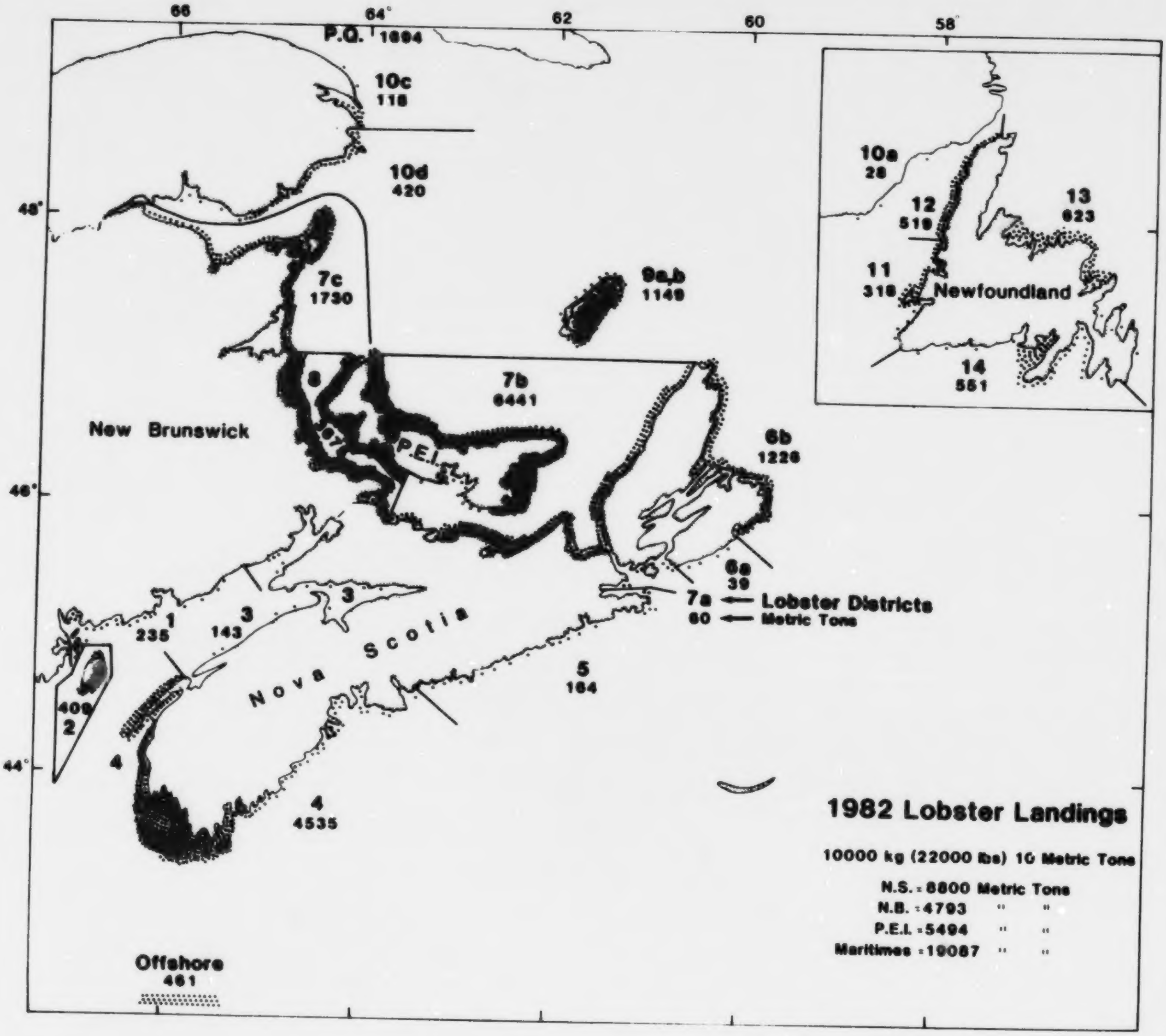

66
64°
62
60
58°
48°
46°
44°
P.Q. 1694
10c
118
10d
420
7c
1730
9a,b
1149
8
67
P.E.I.
7b
6441
New Brunswick
6b
1226
6a
39
7a ← Lobster Districts
60 ← Metric Tons
1
235
3
143
3
Nova Scotia
5
164
409
2
4
4
4535
Offshore
461
10a
28
12
519
13
623
11
318
Newfoundland
14
551
1982 Lobster Landings
10000 kg (22000 lbs) 10 Metric Tons
N.S. = 8800 Metric Tons
N.B. = 4793 " "
P.E.I. = 5494 " "
Maritimes = 19087 " "

Figure 3

TOTAL GROUNDFISH

Average catch per day obtained by
Canadian otter trawlers of tonnage classes 4 and 5
in Subareas 2, 3 and 4.

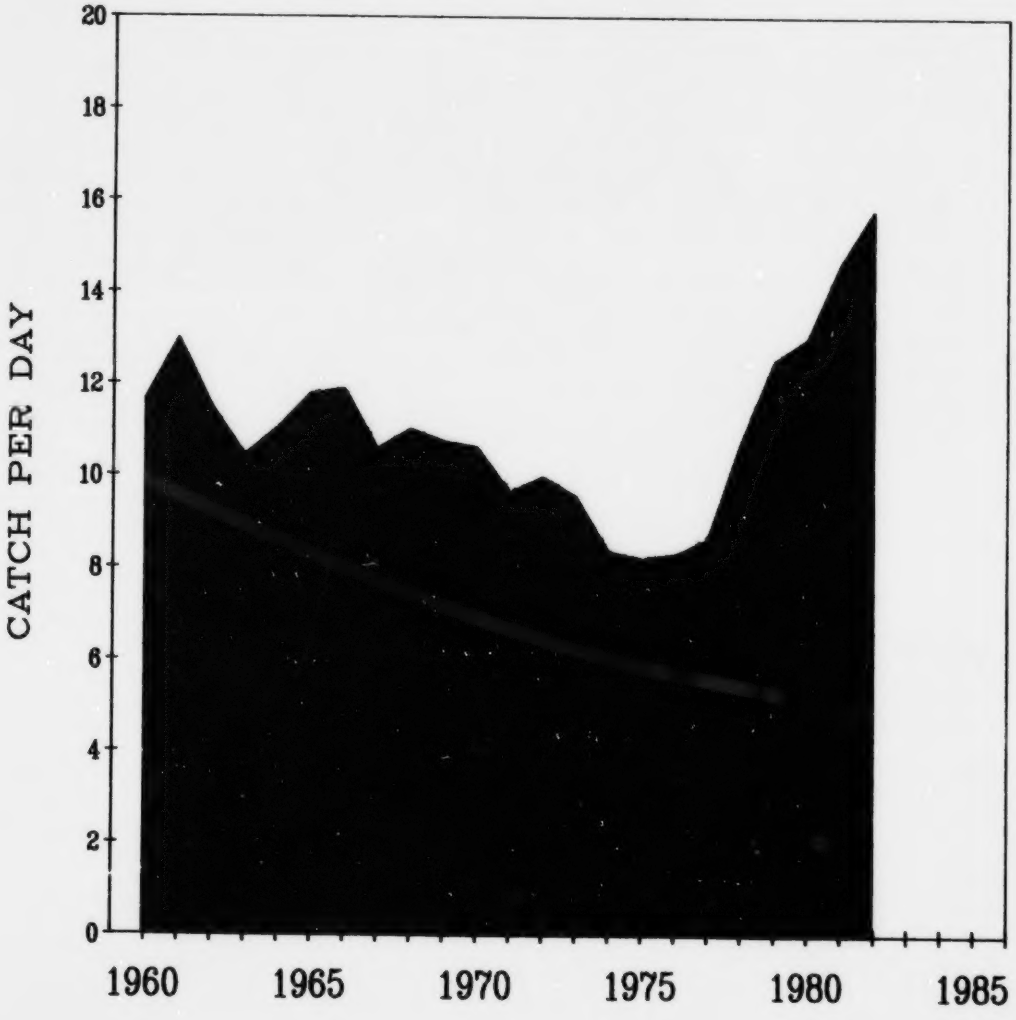


Figure 4

By species
and by
major species groups

TOTAL FINFISH

Landings for 1965–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990, from NAFO Subareas 2–4.
Landings for 1983 are preliminary estimates.

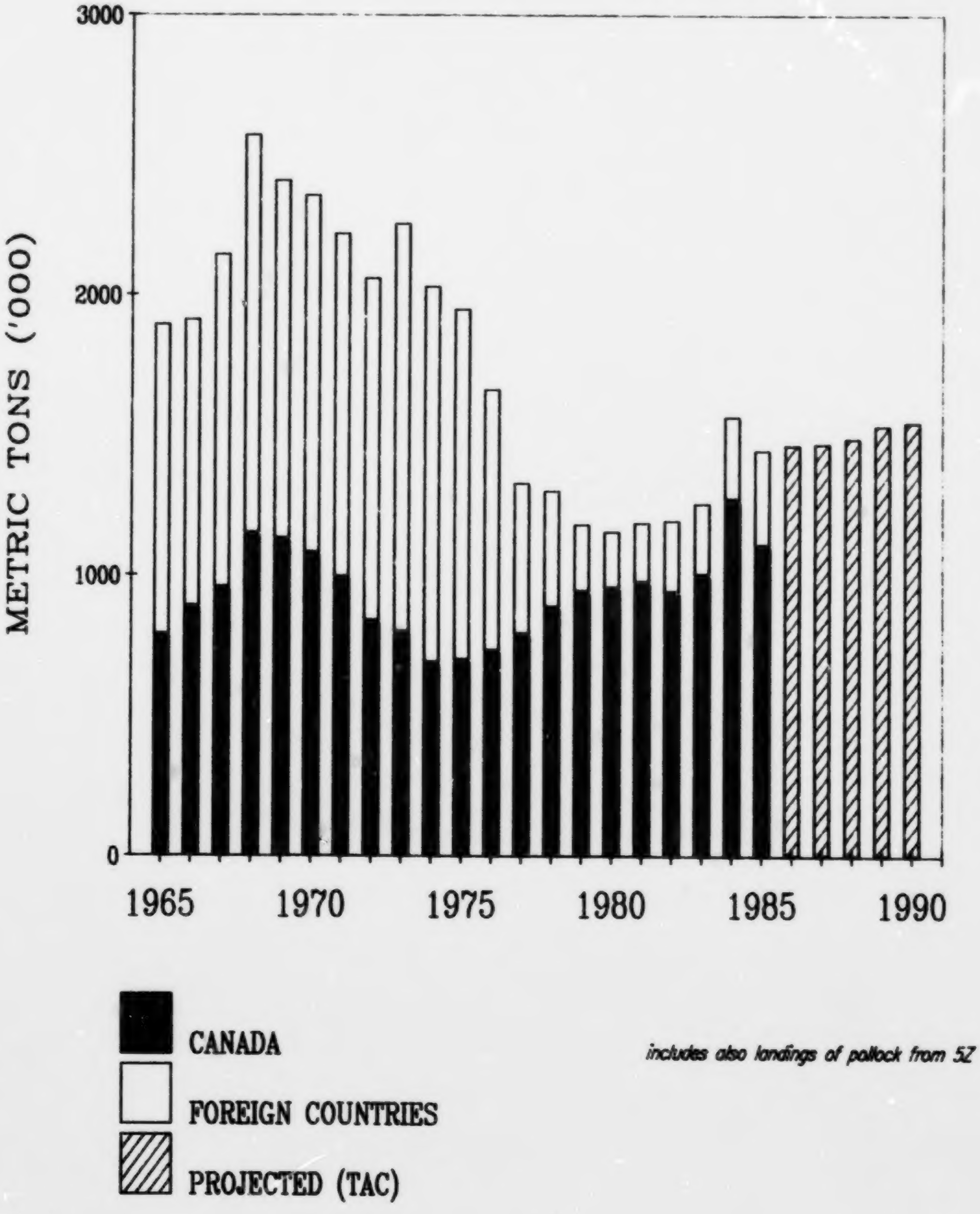
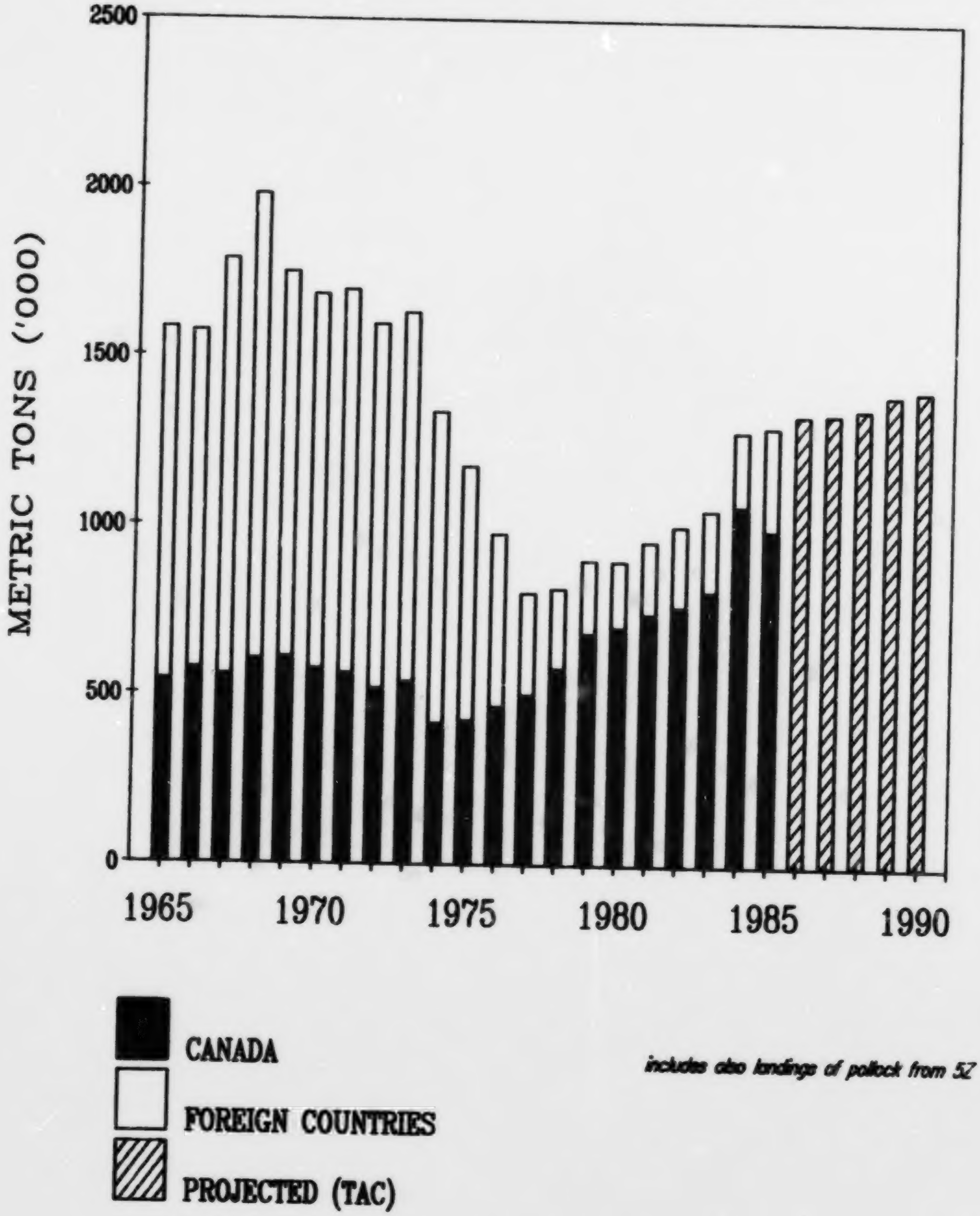


Figure 5

TOTAL GROUNDFISH

Landings for 1965–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990, from NAFO Subareas 2–4.
Landings for 1983 are preliminary estimates.



includes also landings of pollock from 5Z

Figure 6

MOLLUSCS AND CRUSTACEANS

Landings by Canada, 1960-1983.
The 1983 landings are preliminary estimates.

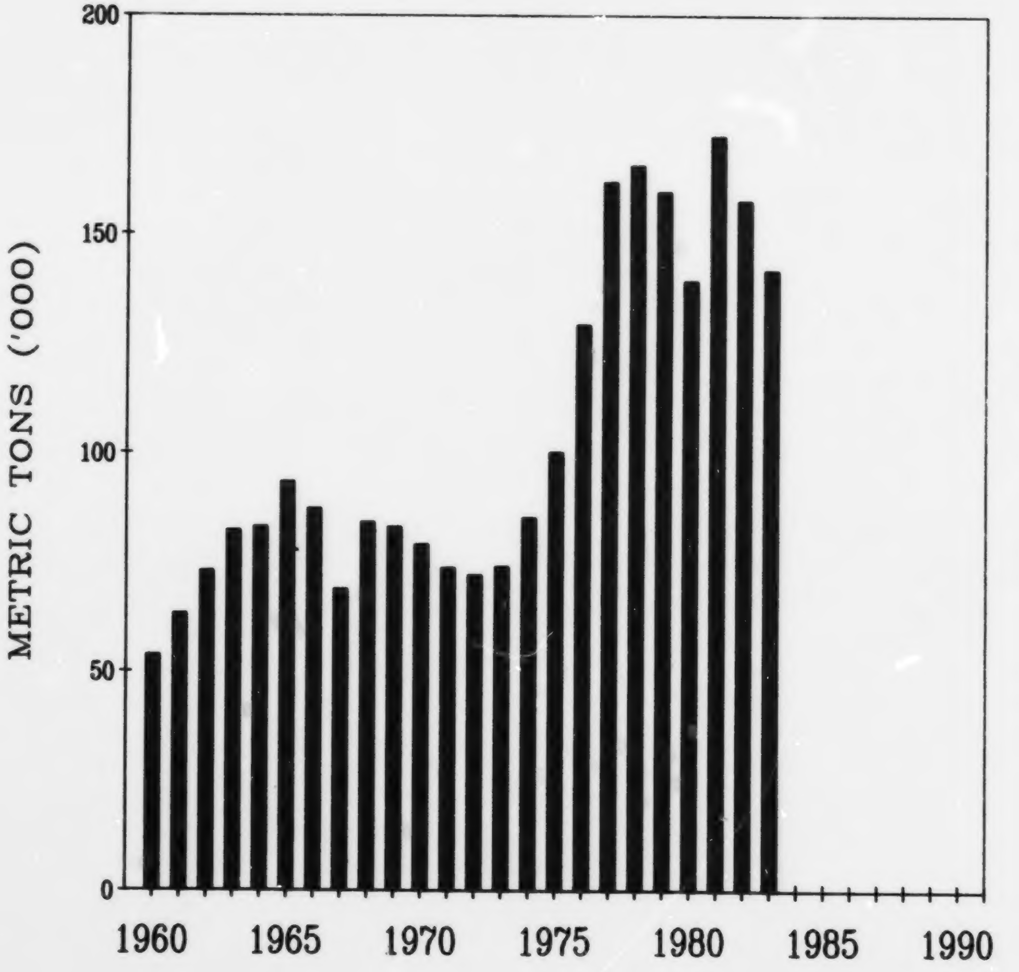


Figure 7

COD

Landings for 1960-1983, TAC for 1984 and 1985, and projected TAC for 1986-1990, from NAFO Subareas 2-4. Landings for 1983 are preliminary estimates.

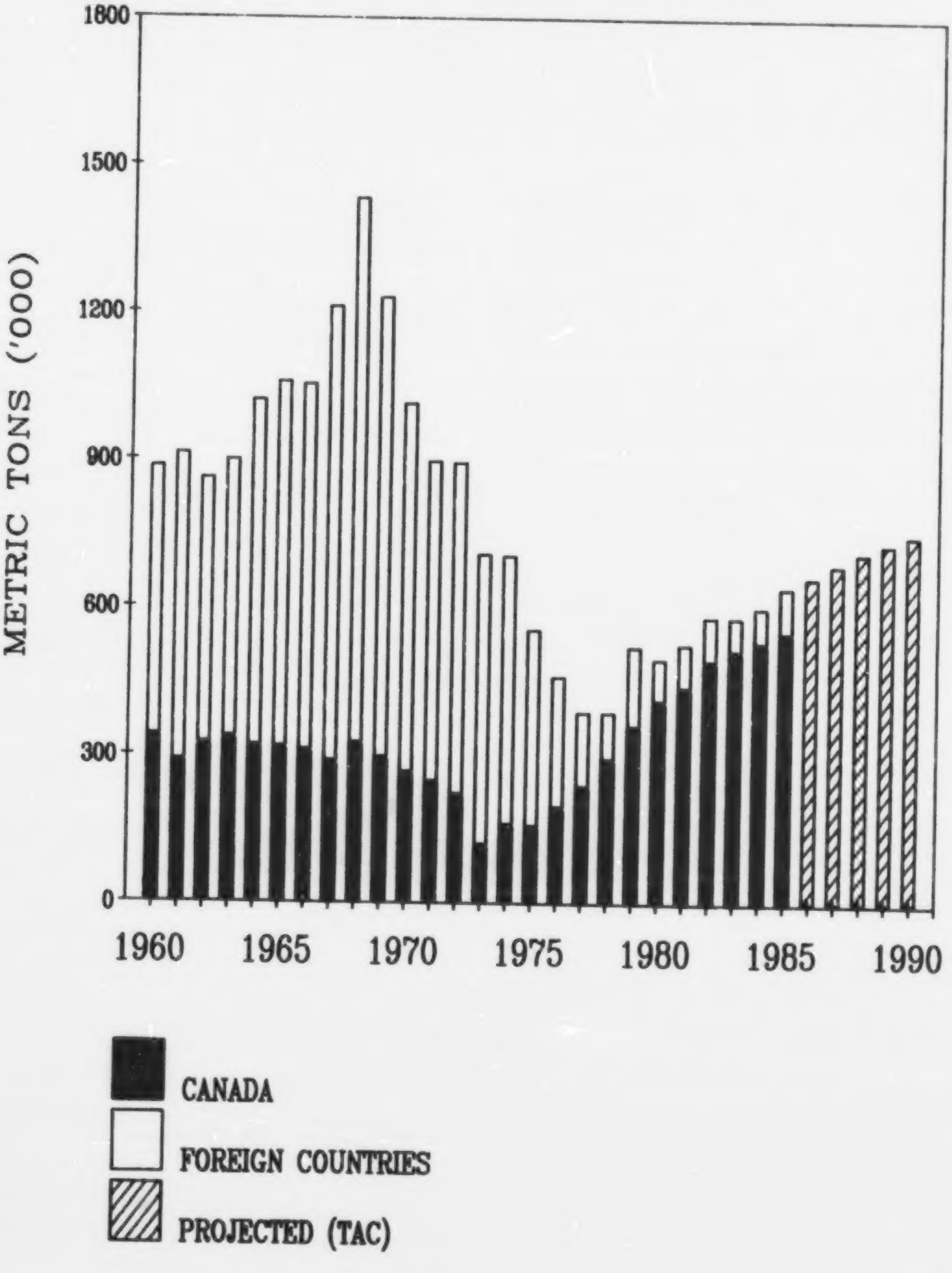


Figure 8

POLLOCK

Landings for 1960–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990, from NAFO Subareas 2–5.
Landings for 1983 are preliminary estimates.

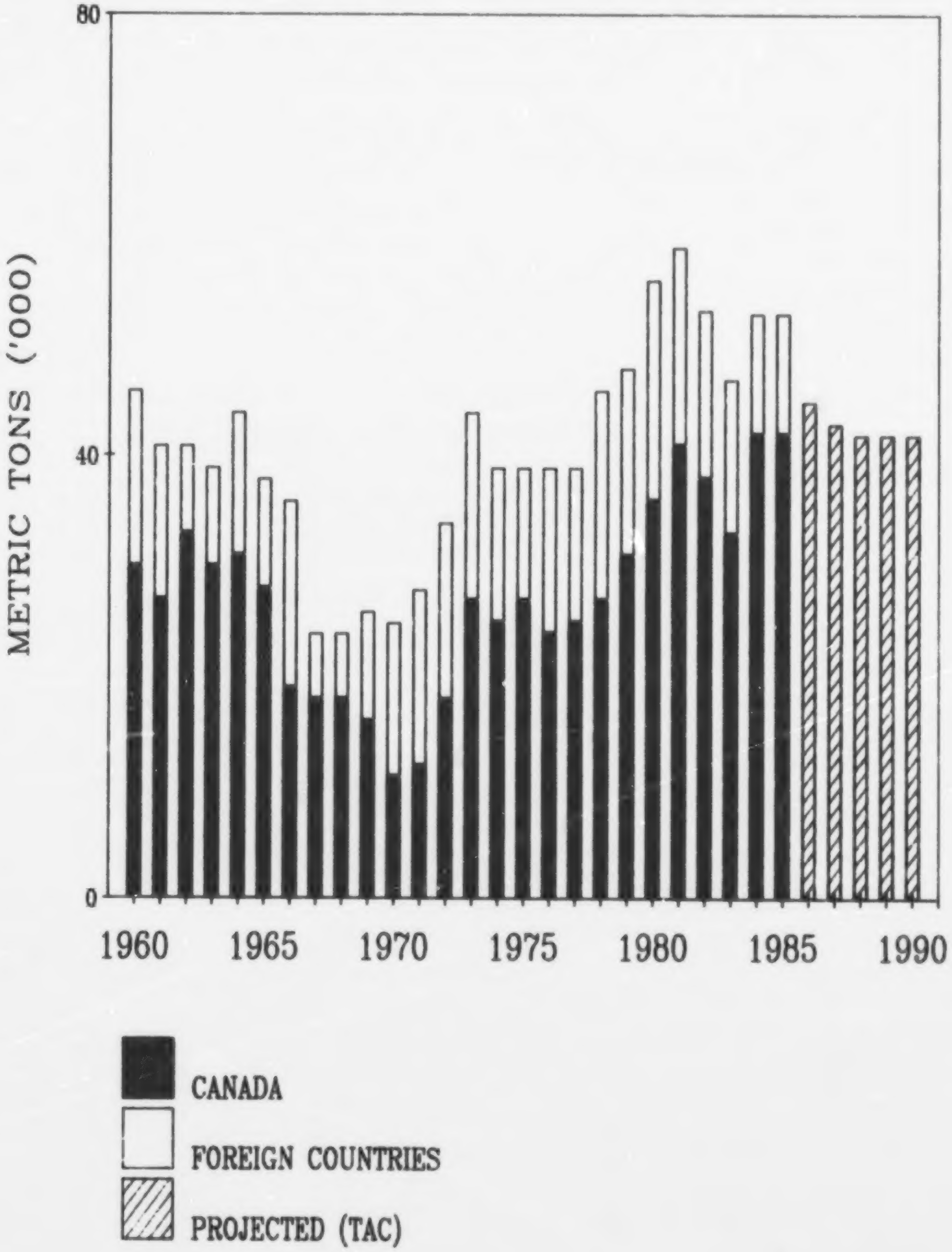


Figure 9

SILVER HAKE

Landings for 1960–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990, from NAFO Subareas 2-4.
Landings for 1983 are preliminary estimates.

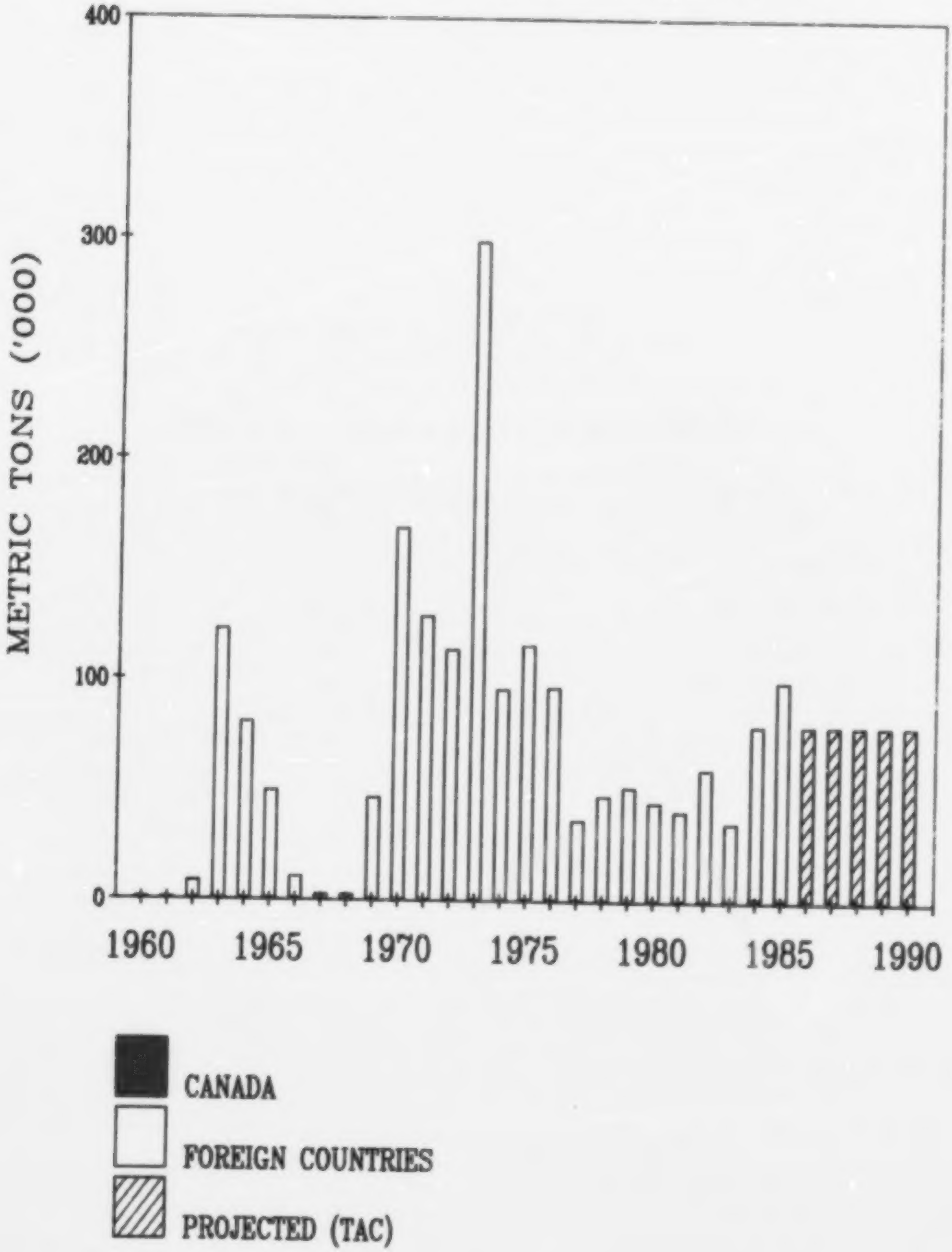


Figure 10

HADDOCK

Landings for 1960–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990, from NAFO Subareas 2–4.
Landings for 1983 are preliminary estimates.

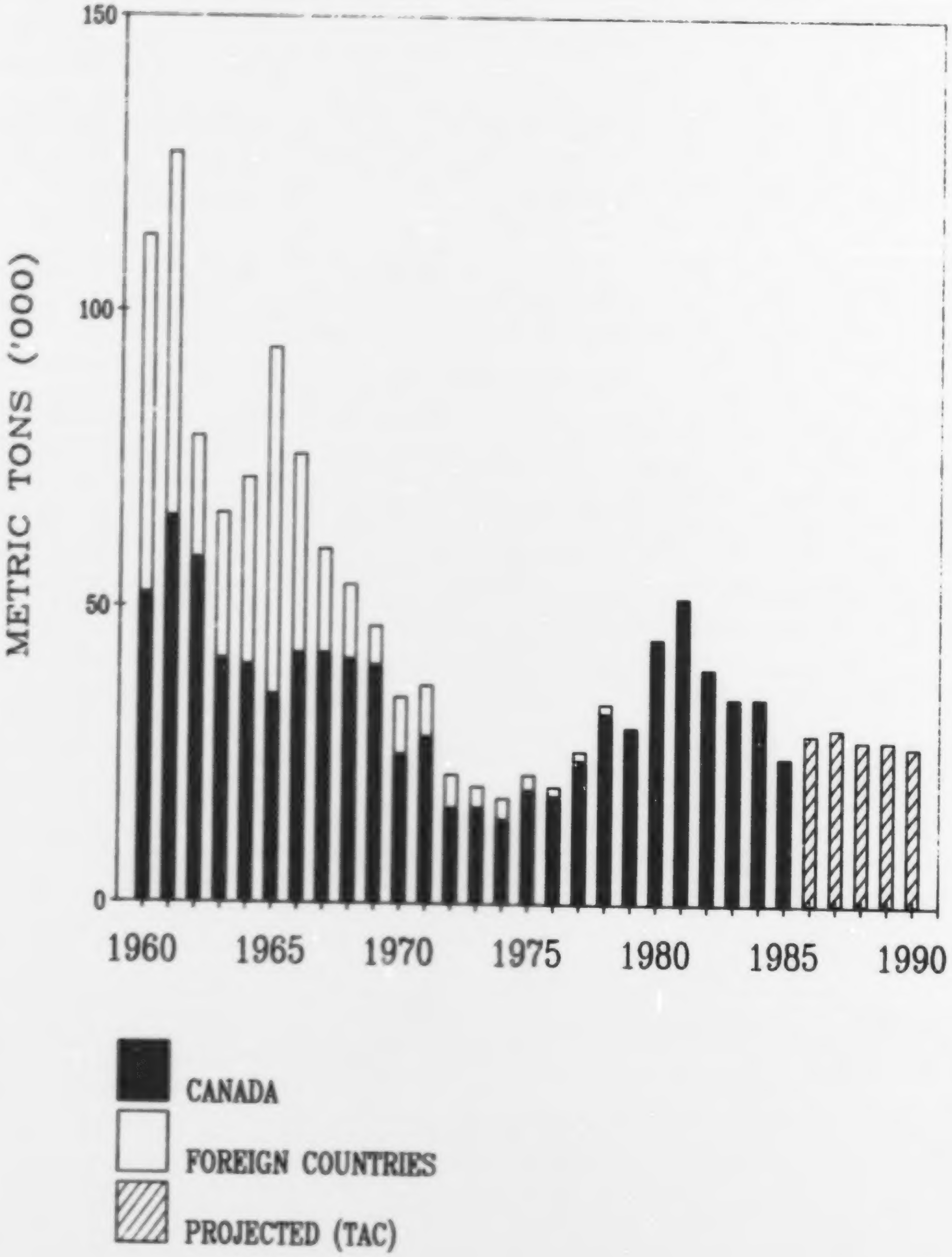


Figure 11

REDFISH

Landings for 1960–1983, TAC for 1984 and 1985, and projected TAC for 1986–1990, from NAFO Subareas 2–4. Landings for 1983 are preliminary estimates.

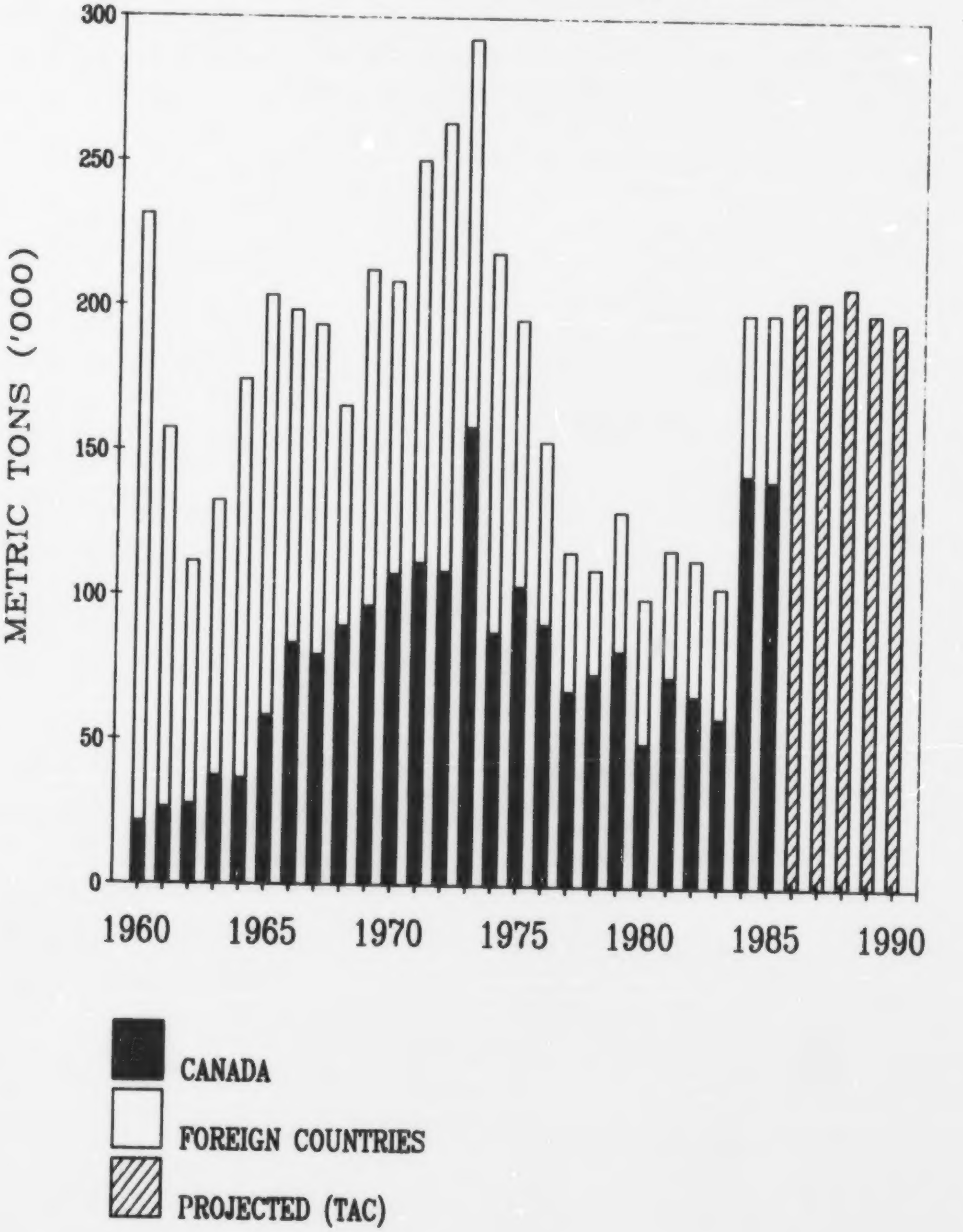


Figure 12

FLATFISH

Landings for 1963–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990, from NAFO Subareas 2–4.
Landings for 1983 are preliminary estimates.

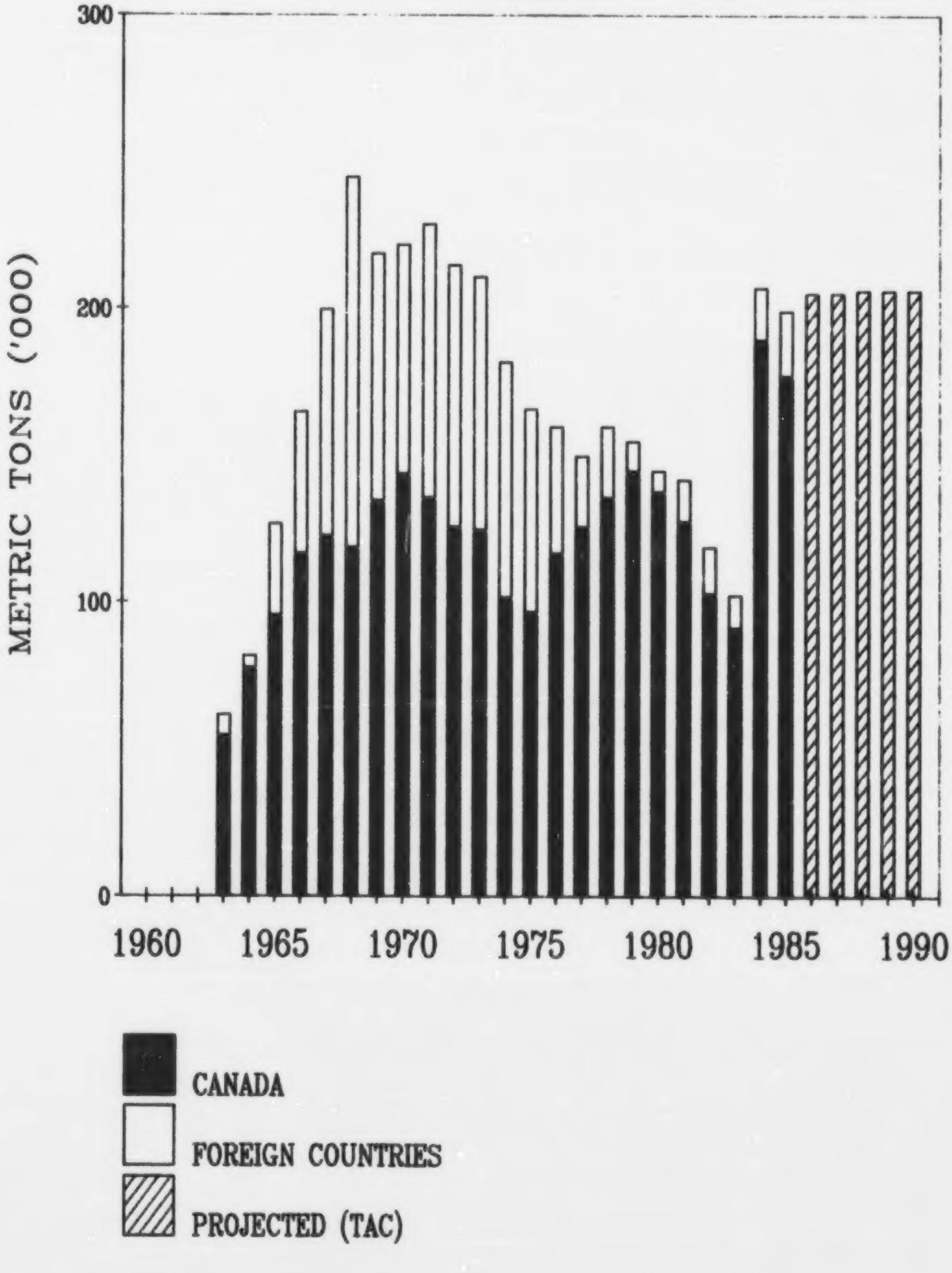
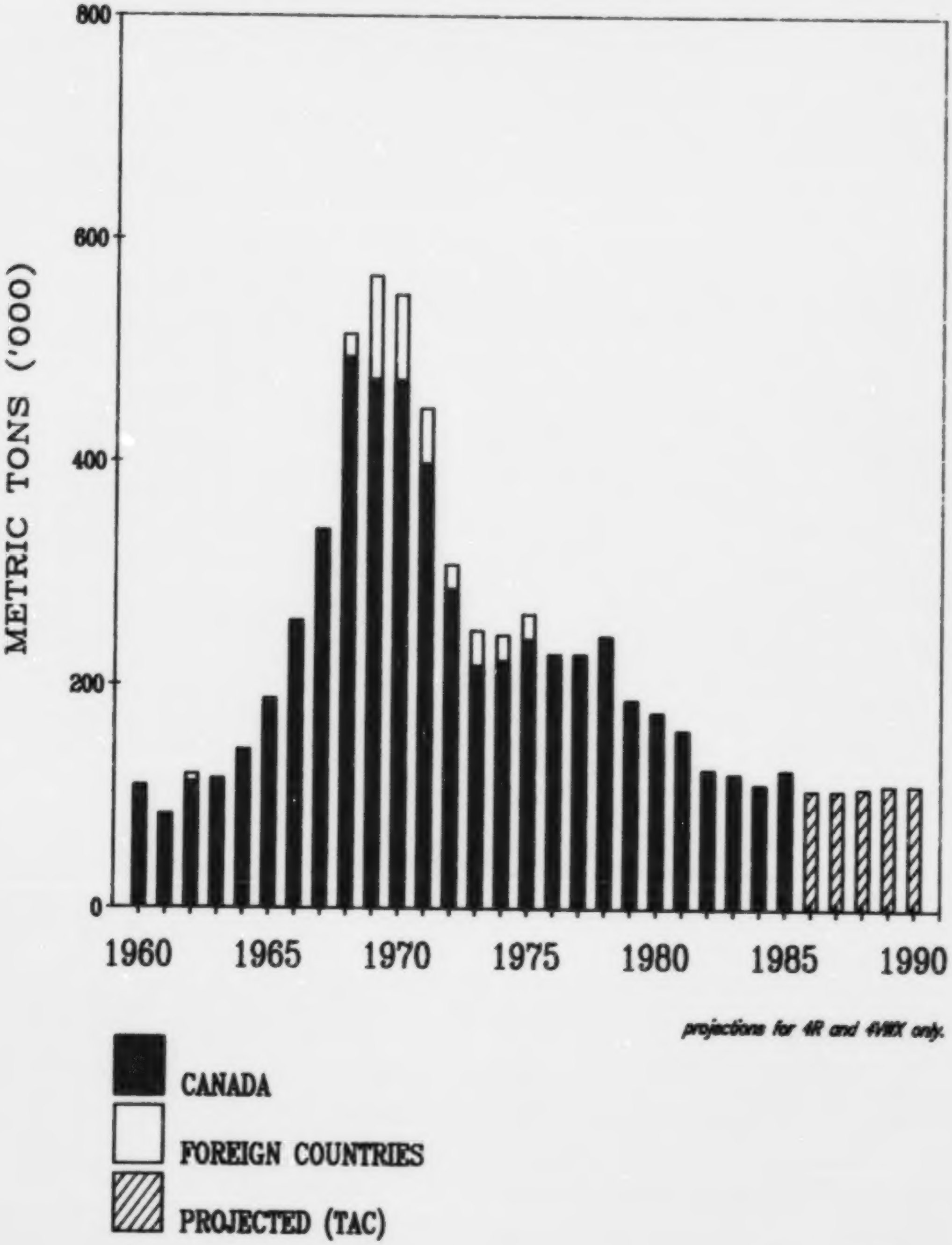


Figure 13

TOTAL HERRING

Landings for 1960–1983, TAC for 1984 and 1985
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.



projections for 4R and 4VWX only.

Figure 14

CAPELIN

Landings for 1970–1983, TAC for 1984 and 1985.
Landings for 1983 are preliminary estimates.

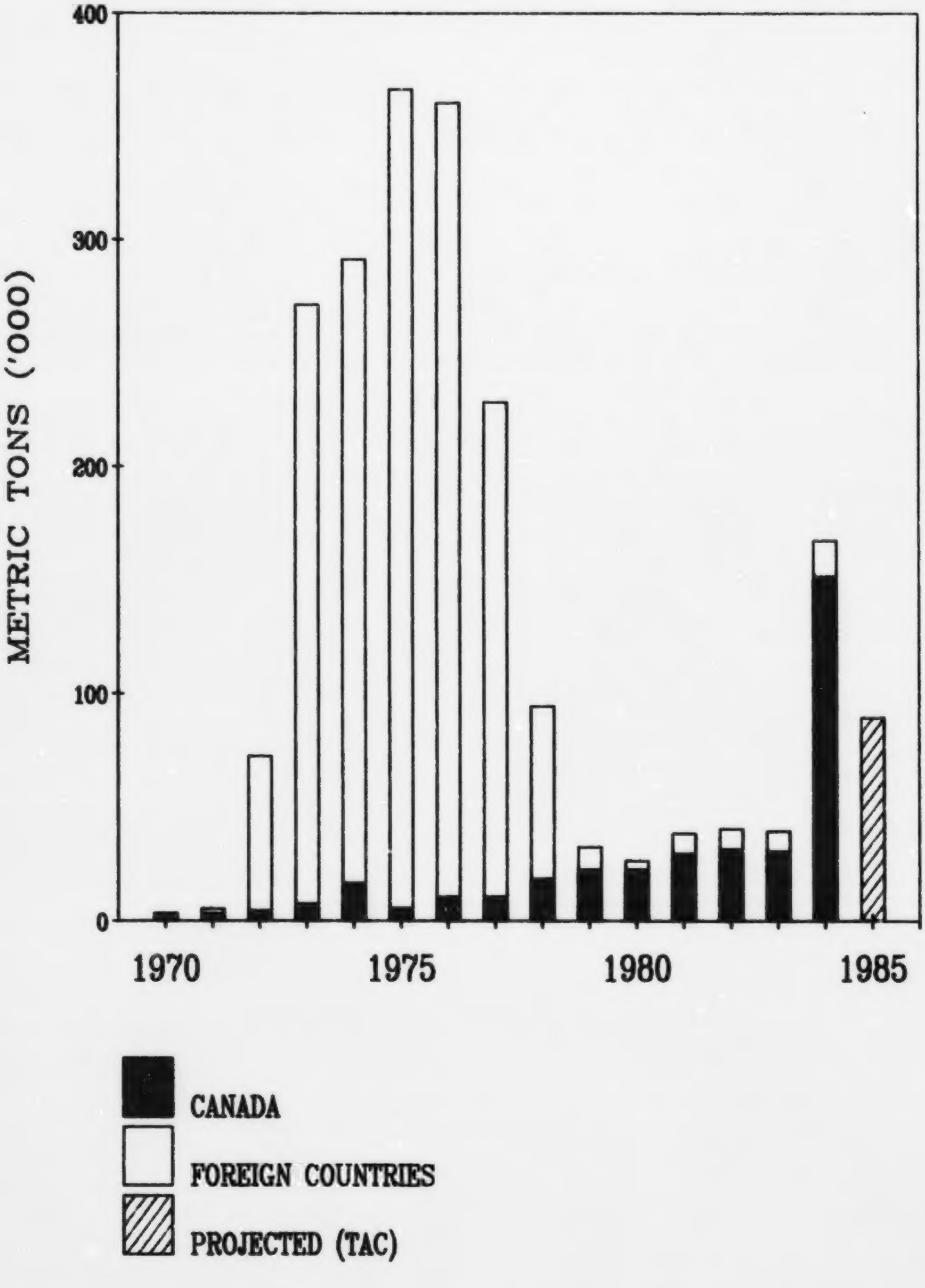
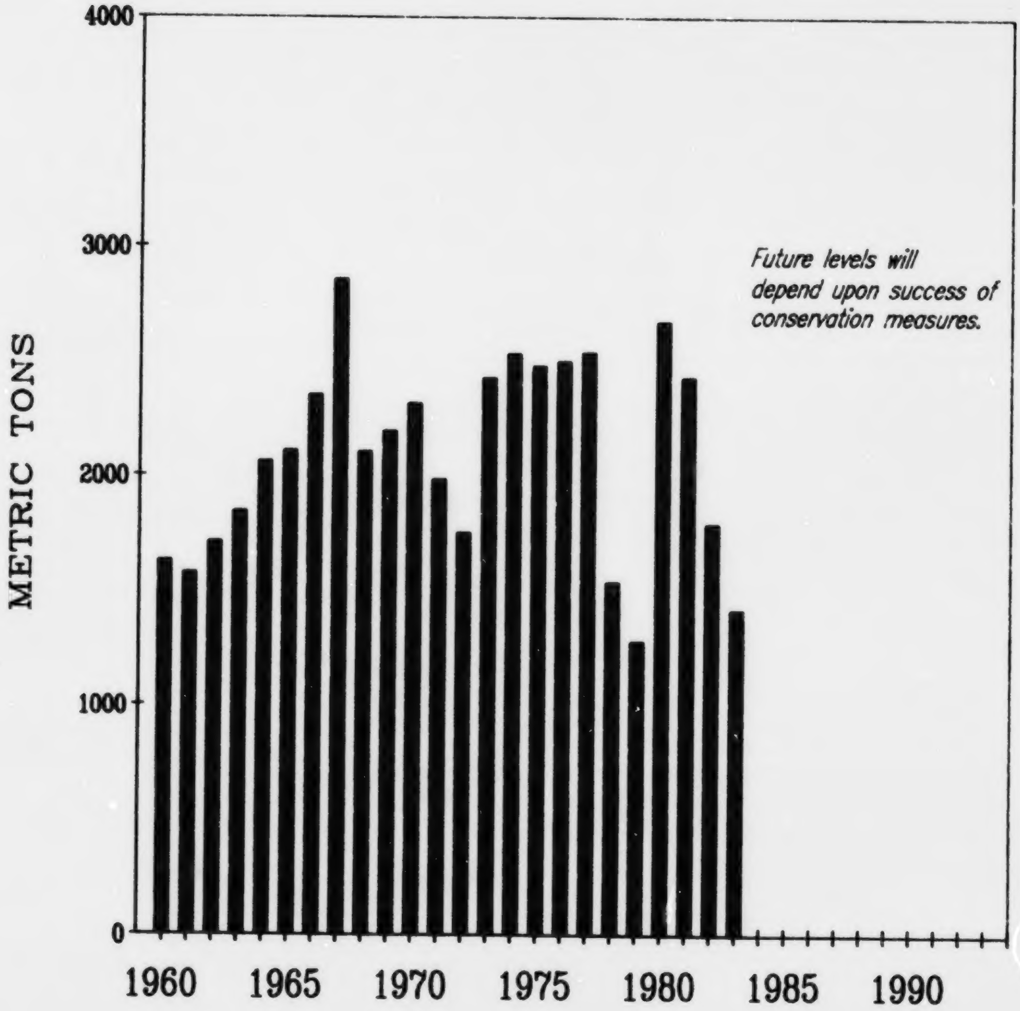


Figure 15

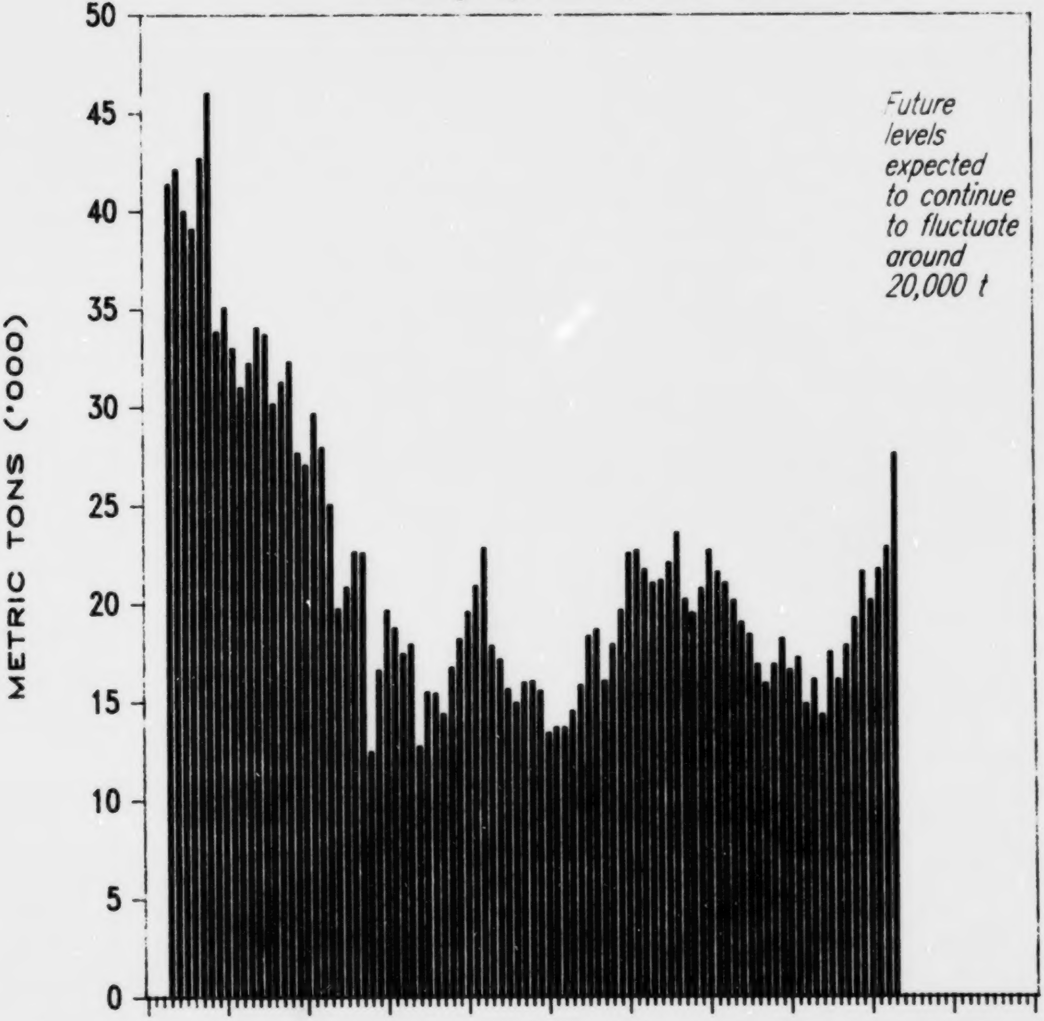
ATLANTIC SALMON

Landings by Canada for 1960–1983.
Landings for 1983 are preliminary estimates.



Future levels will depend upon success of conservation measures.

Figure 16



LOBSTER

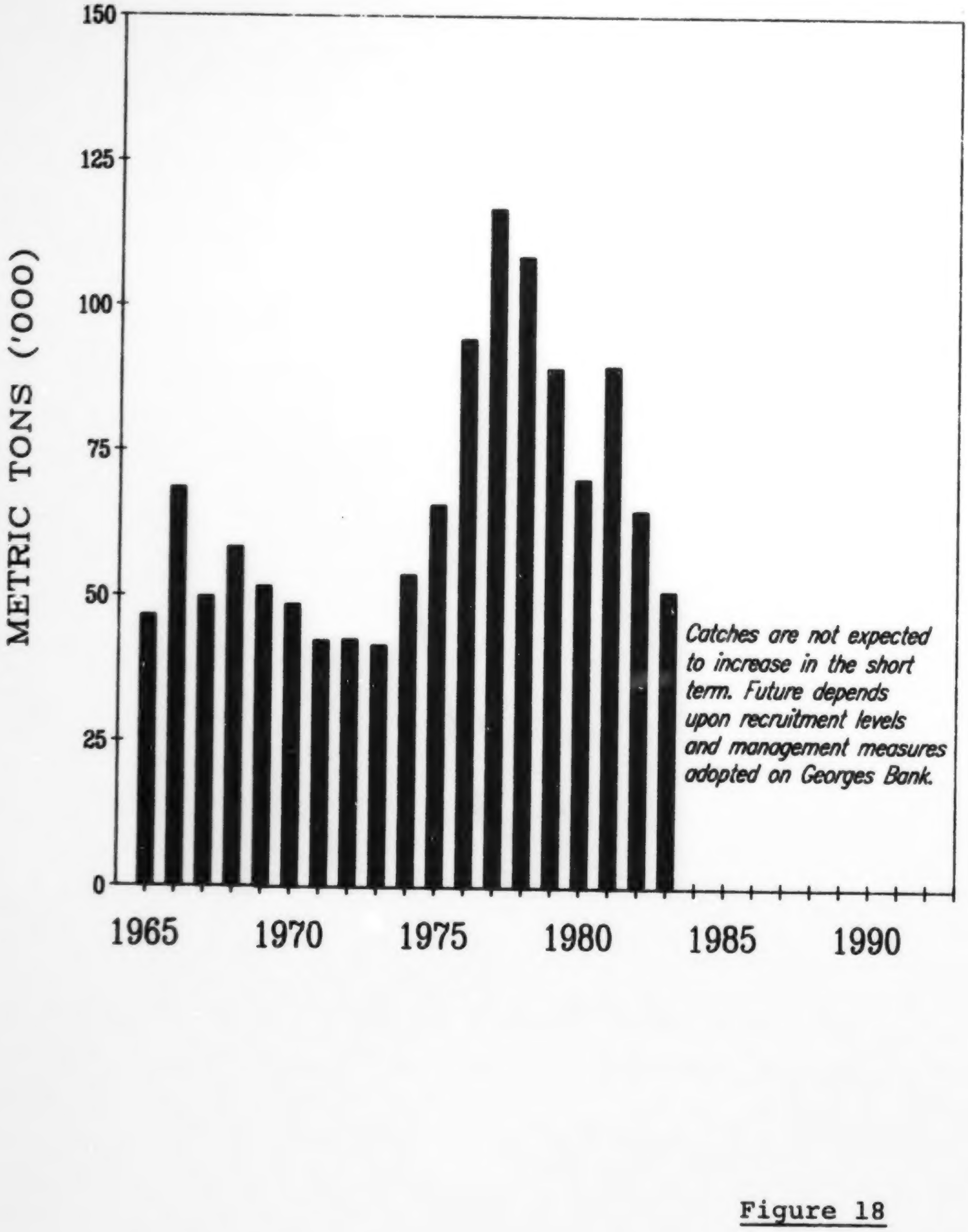
Landings by Canada, 1893–1983.

Future levels expected to continue to fluctuate around 20,000 t

Figure 17

SCALLOP

Landings (round weight) by Canada from NAFO Subareas 1–6, 1965–1983. Landings for 1983 are preliminary estimates.

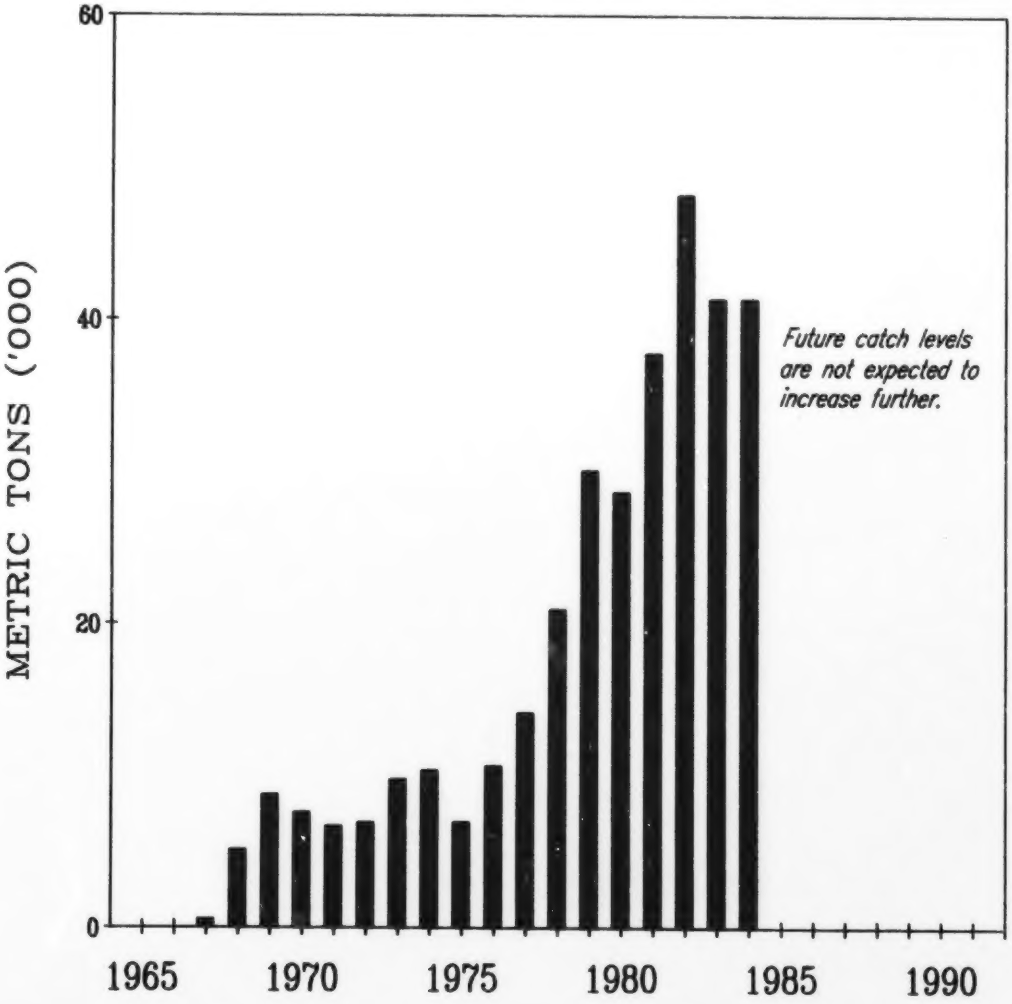


Catches are not expected to increase in the short term. Future depends upon recruitment levels and management measures adopted on Georges Bank.

Figure 18

SNOW CRAB

Landings by Canada for 1967–1984.
Landings for 1983 and 1984 are preliminary estimates.



Future catch levels are not expected to increase further.

Figure 19

SHRIMP

Landings by Canada from NAFO Subareas 0-6, 1965-1983.
Landings for 1983 are preliminary estimates.

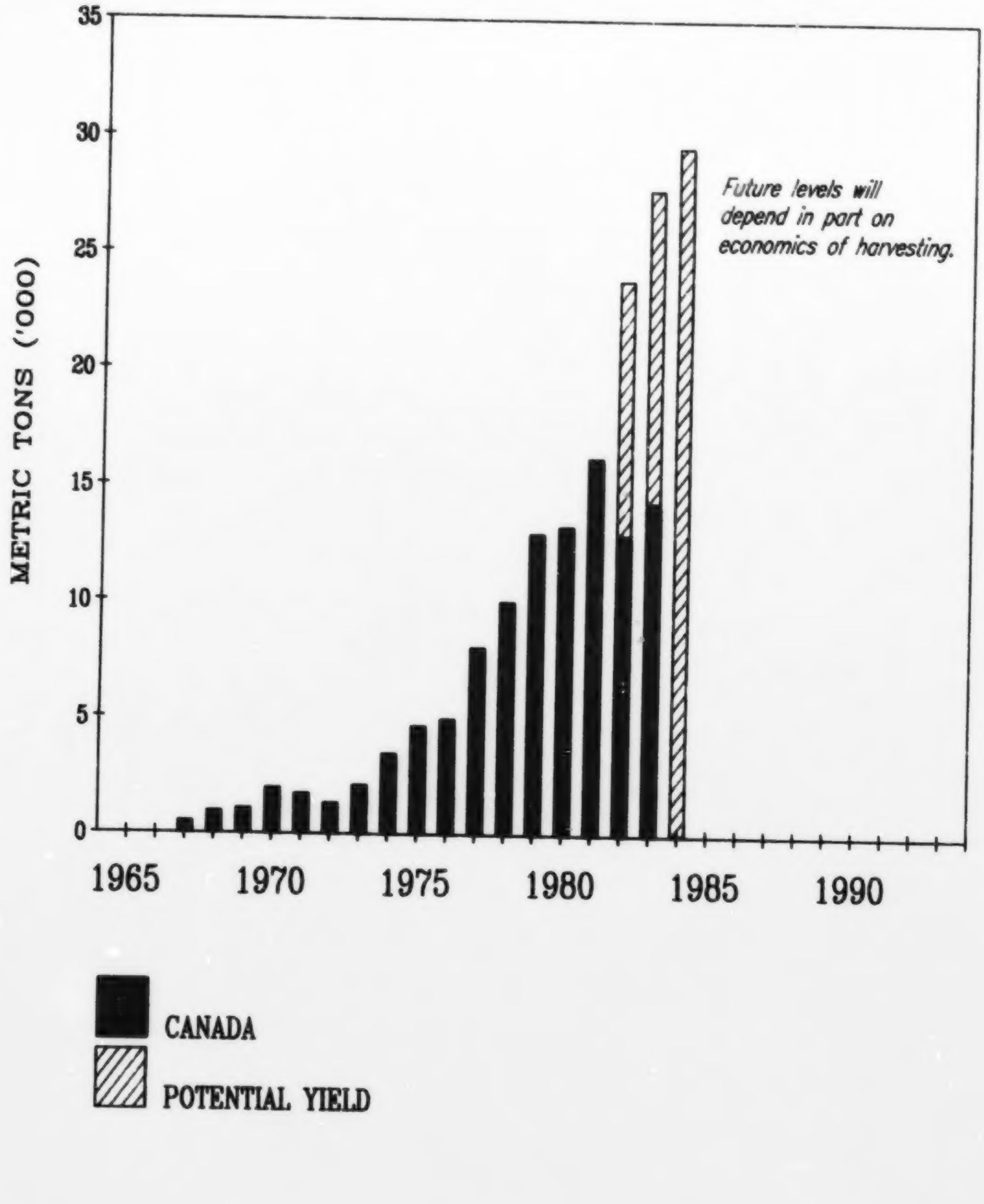


Figure 20

OYSTERS

Landings by Canada, 1960–1983.
The 1983 landings are preliminary estimates.

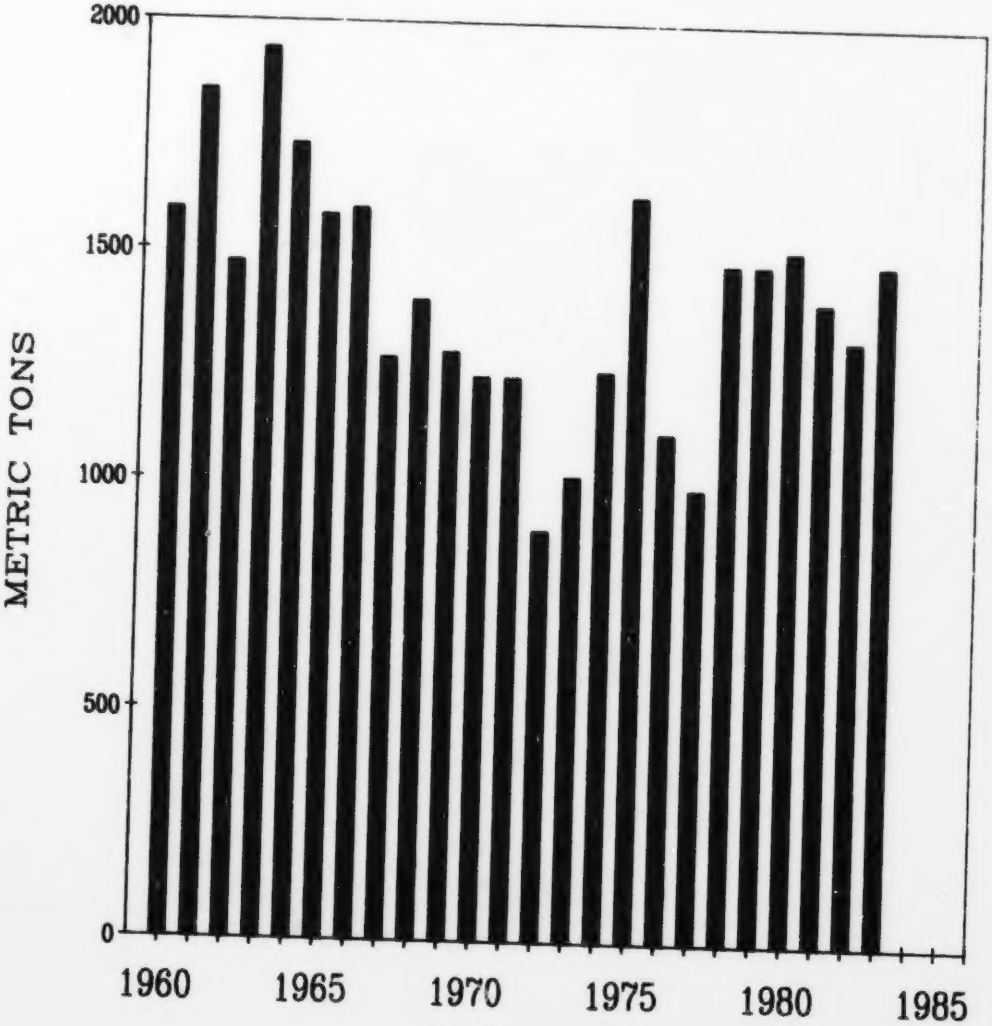


Figure 21

CLAMS

Landings by Canada, 1960–1983.
The 1983 landings are preliminary estimates.

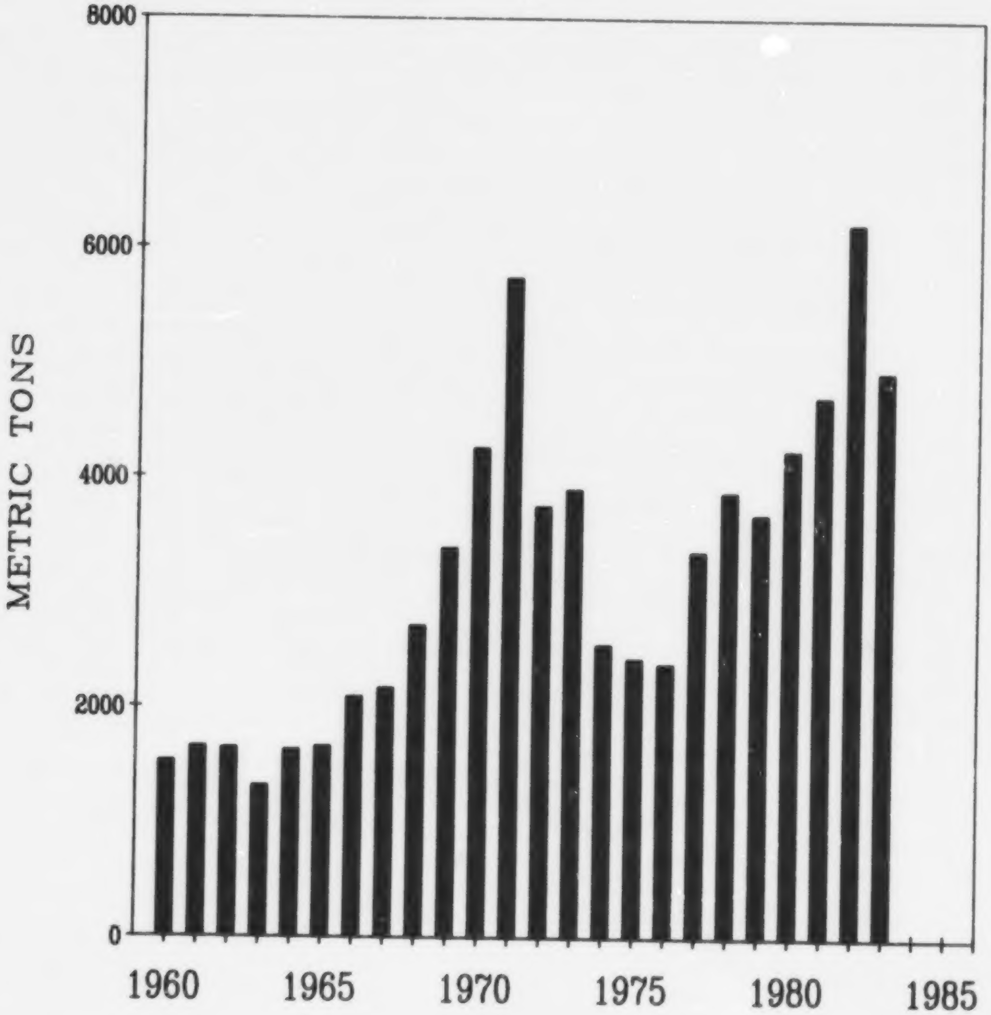


Figure 22

SQUID

Landings by Canada, 1960–1983.
The 1983 landings are preliminary estimates.

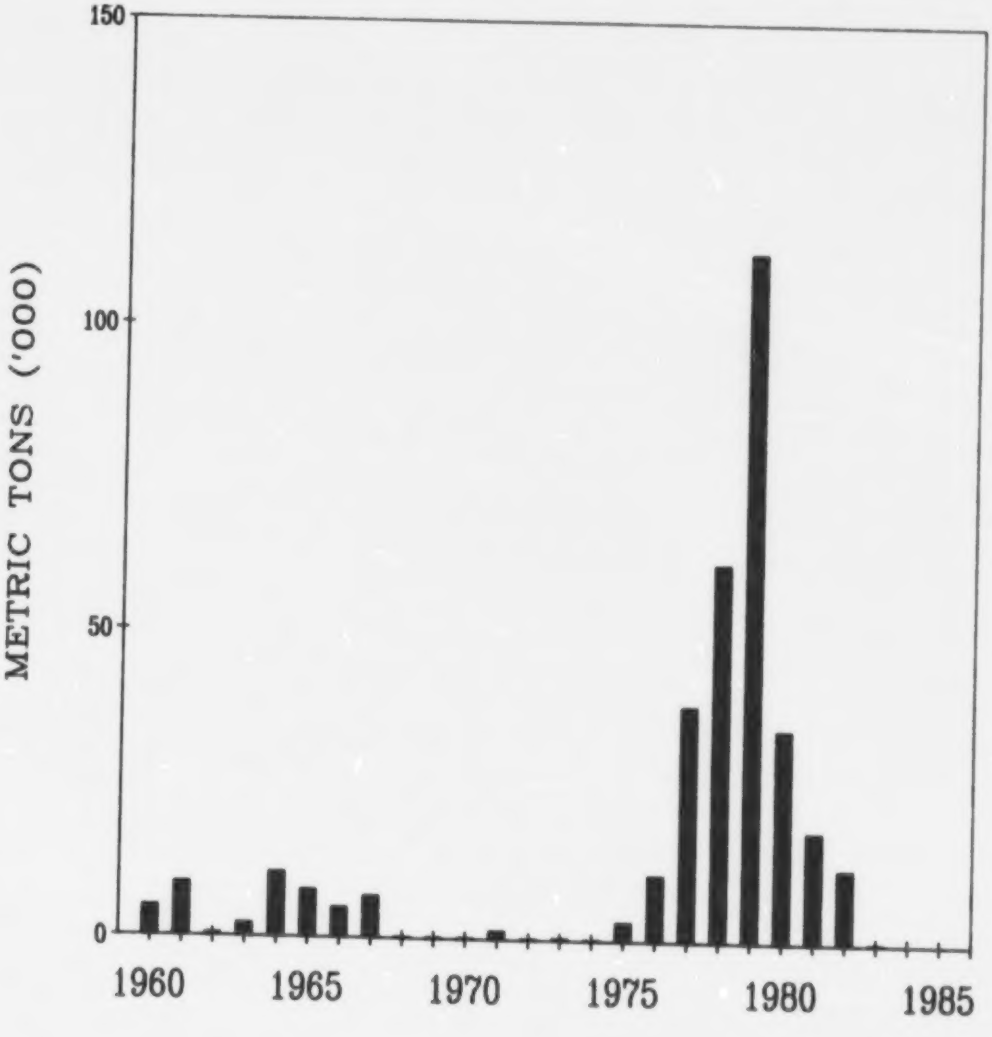
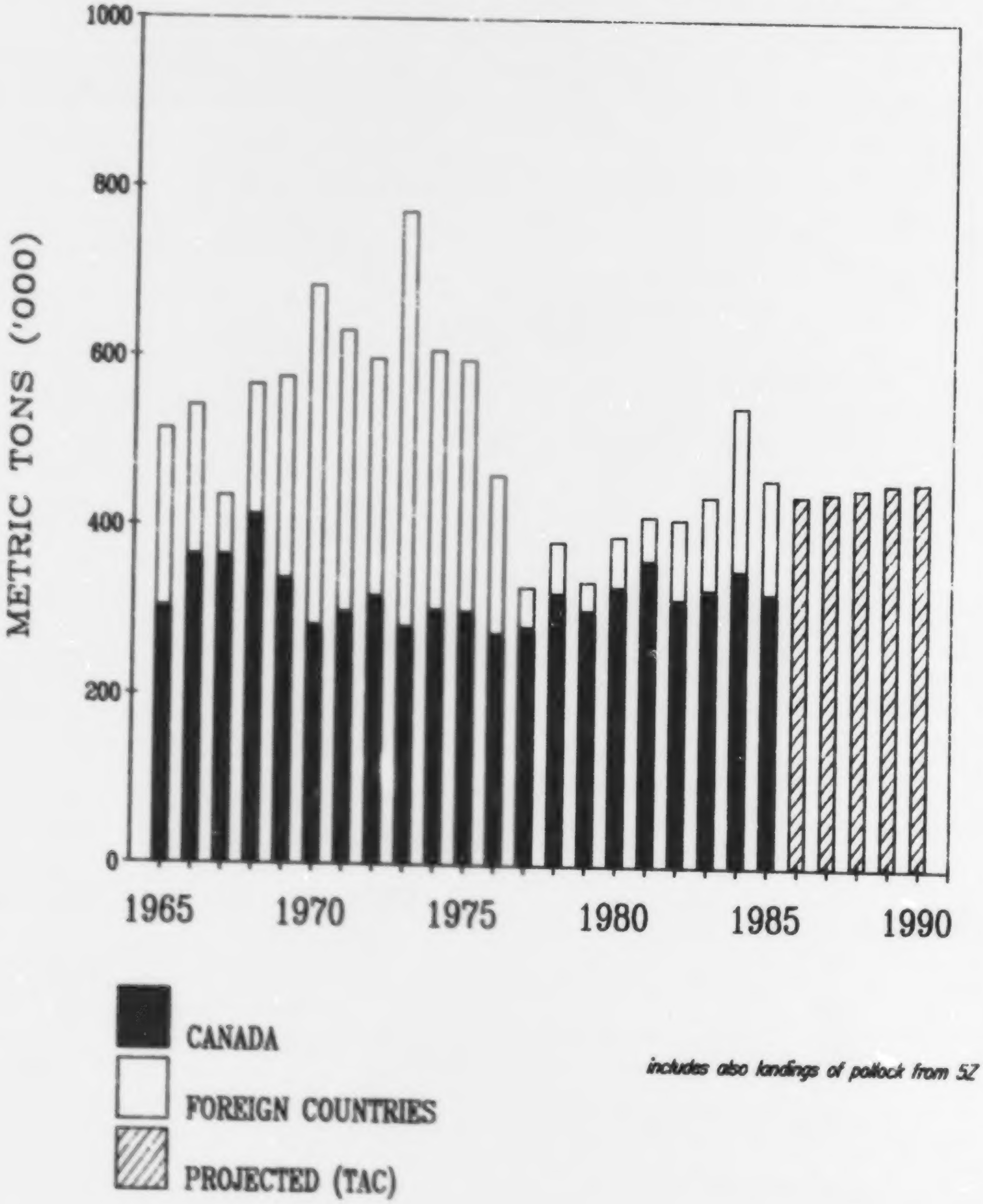


Figure 23

By regions
or
by stocks

FINFISH, Scotian Shelf

Landings for 1965–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.



includes also landings of pollock from 5Z

Figure 24

FINFISH, Gulf of St. Lawrence

Landings for 1965–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.

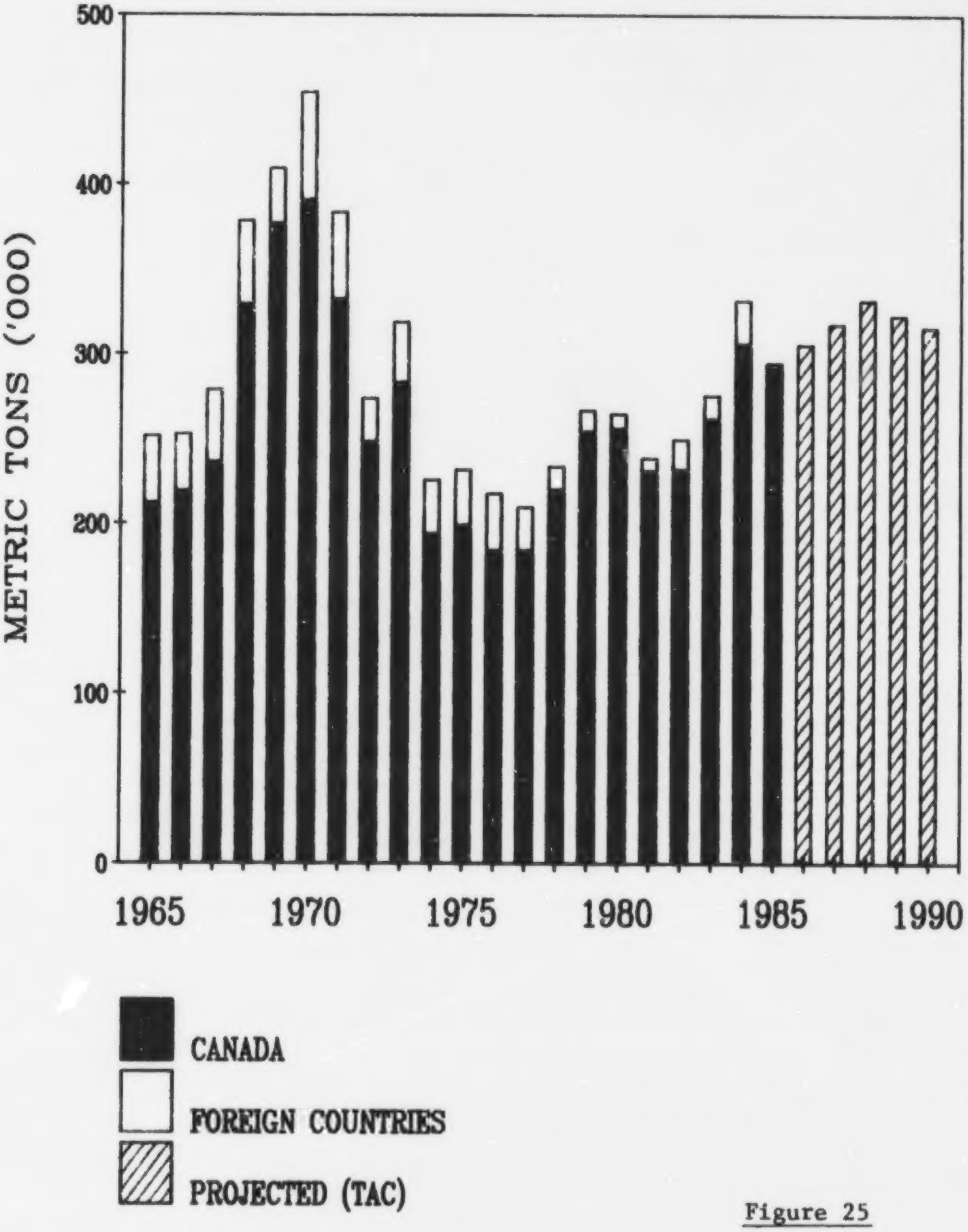


Figure 25

FINFISH, Newfoundland and Labrador

Landings for 1965–1983, TAC for 1984 and 1985, and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.

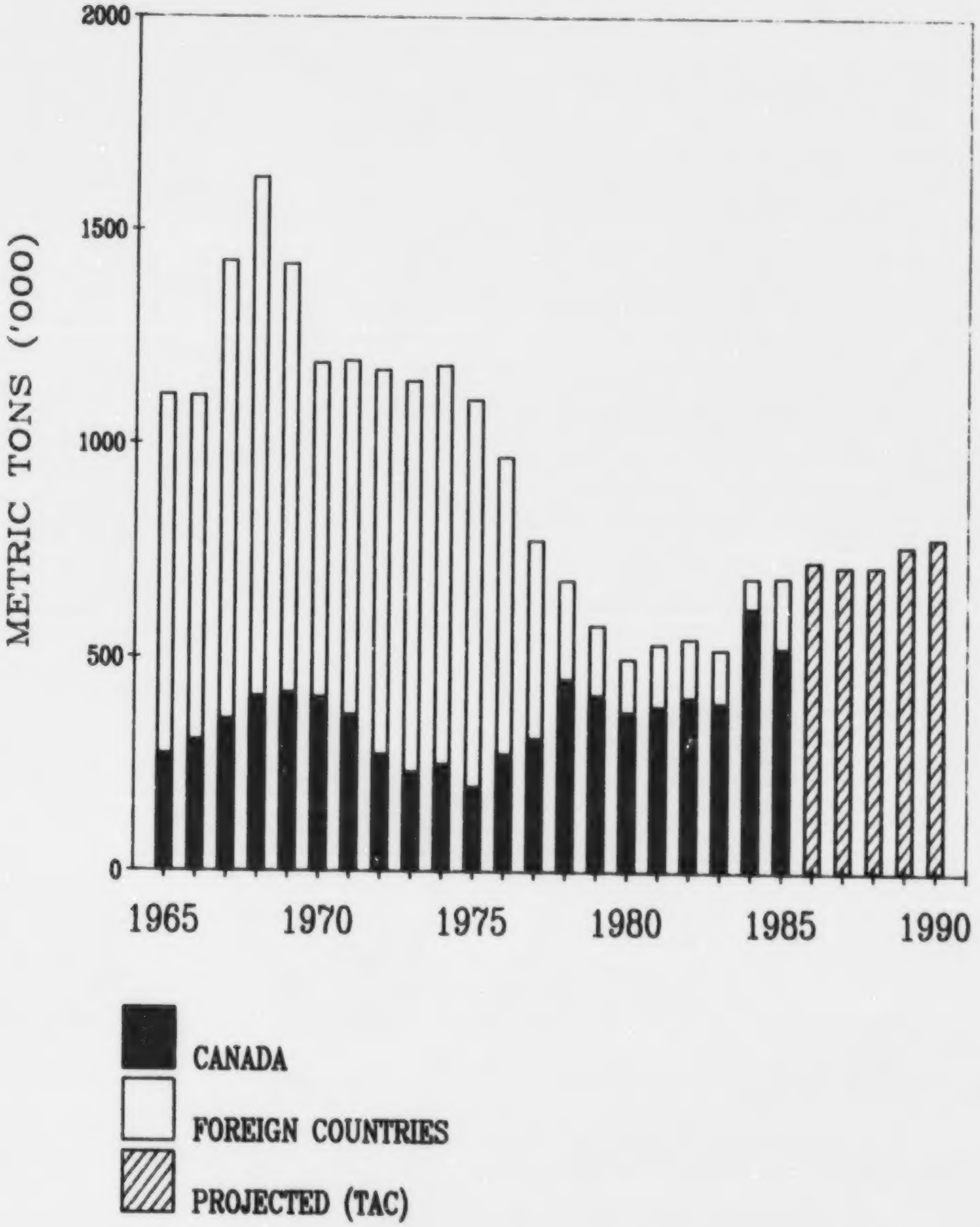
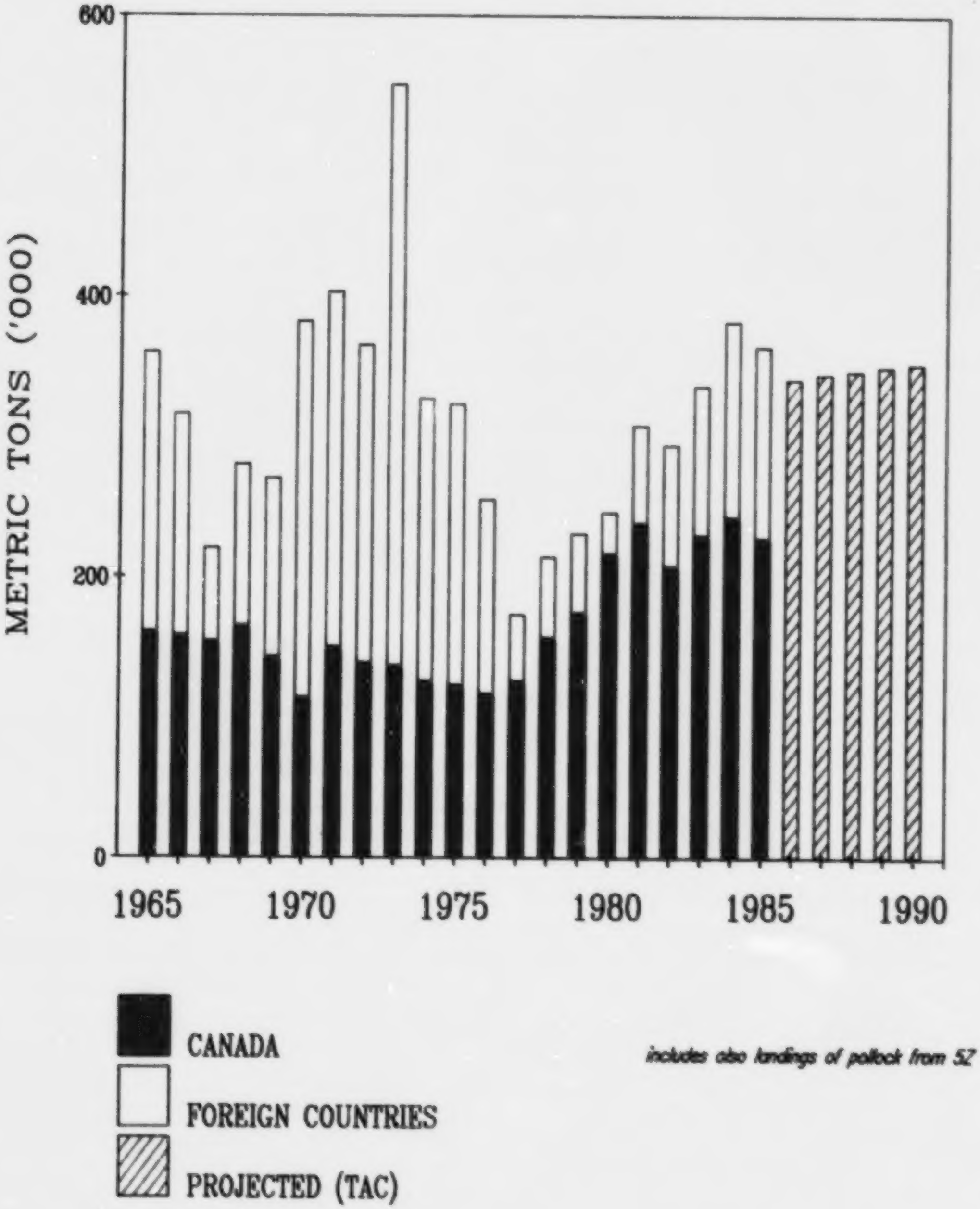


Figure 26

GROUNDFISH, Scotian Shelf

Landings for 1965–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.



includes also landings of pollock from 5Z

Figure 27

GROUNDFISH, Gulf of St. Lawrence

Landings for 1965–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.

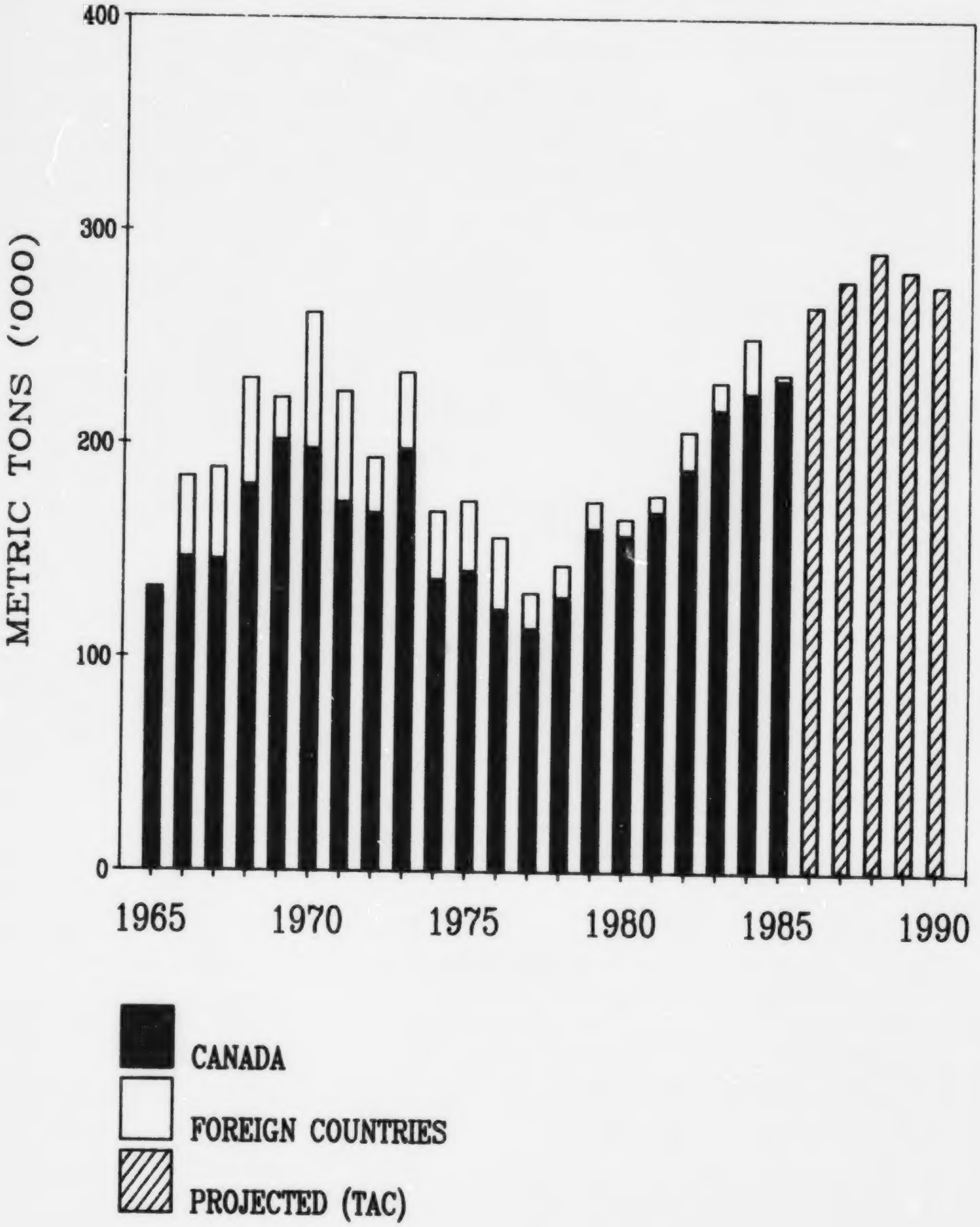


Figure 28

GROUNDFISH, Newfoundland and Labrador.

Landings for 1965–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.

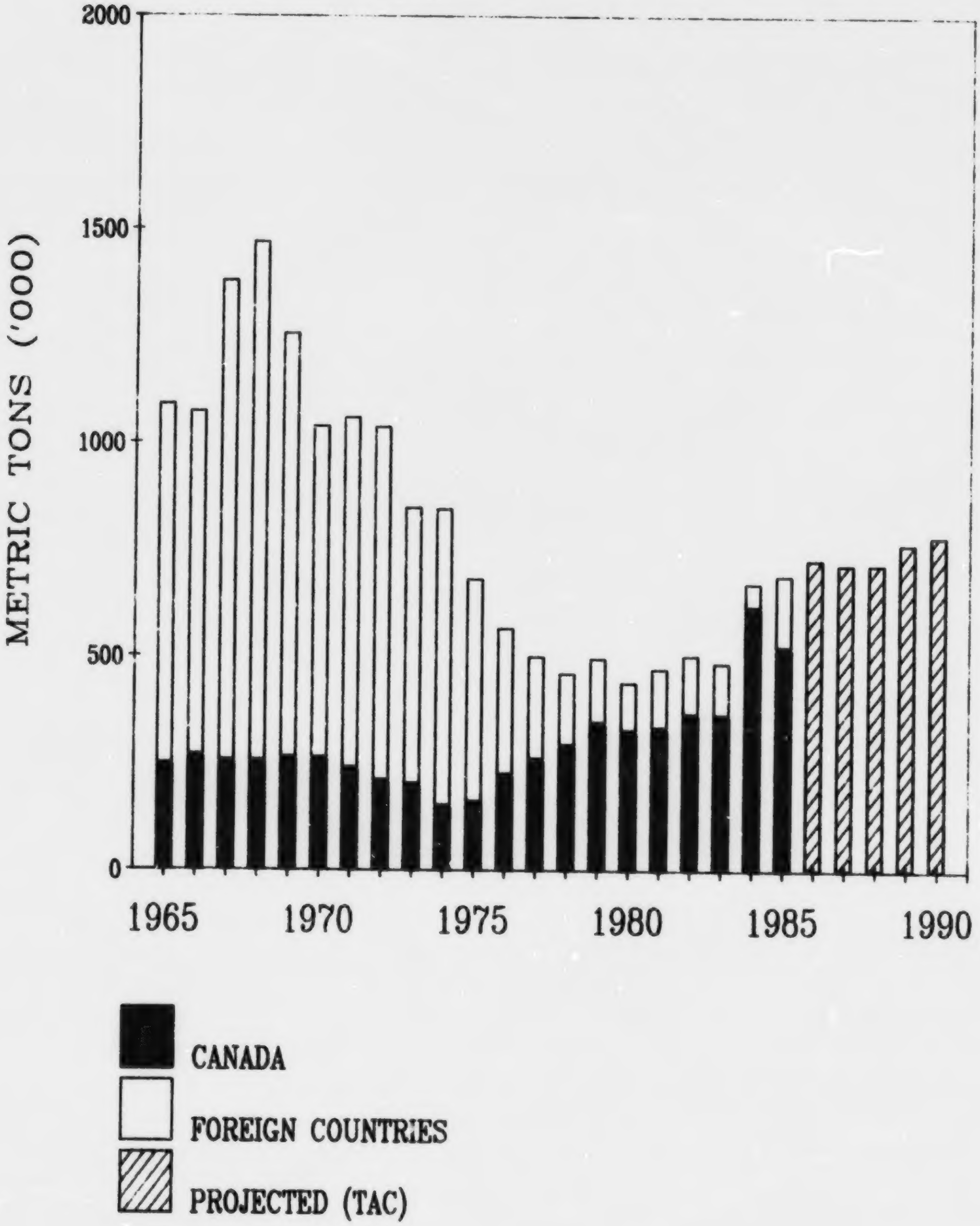


Figure 29

COD, S. Labrador - N.E. Newfoundland (2J-3KL)

Landings for 1960-1983, TAC for 1984 and 1985,
and projected TAC for 1986-1990.
Landings for 1983 are preliminary estimates.

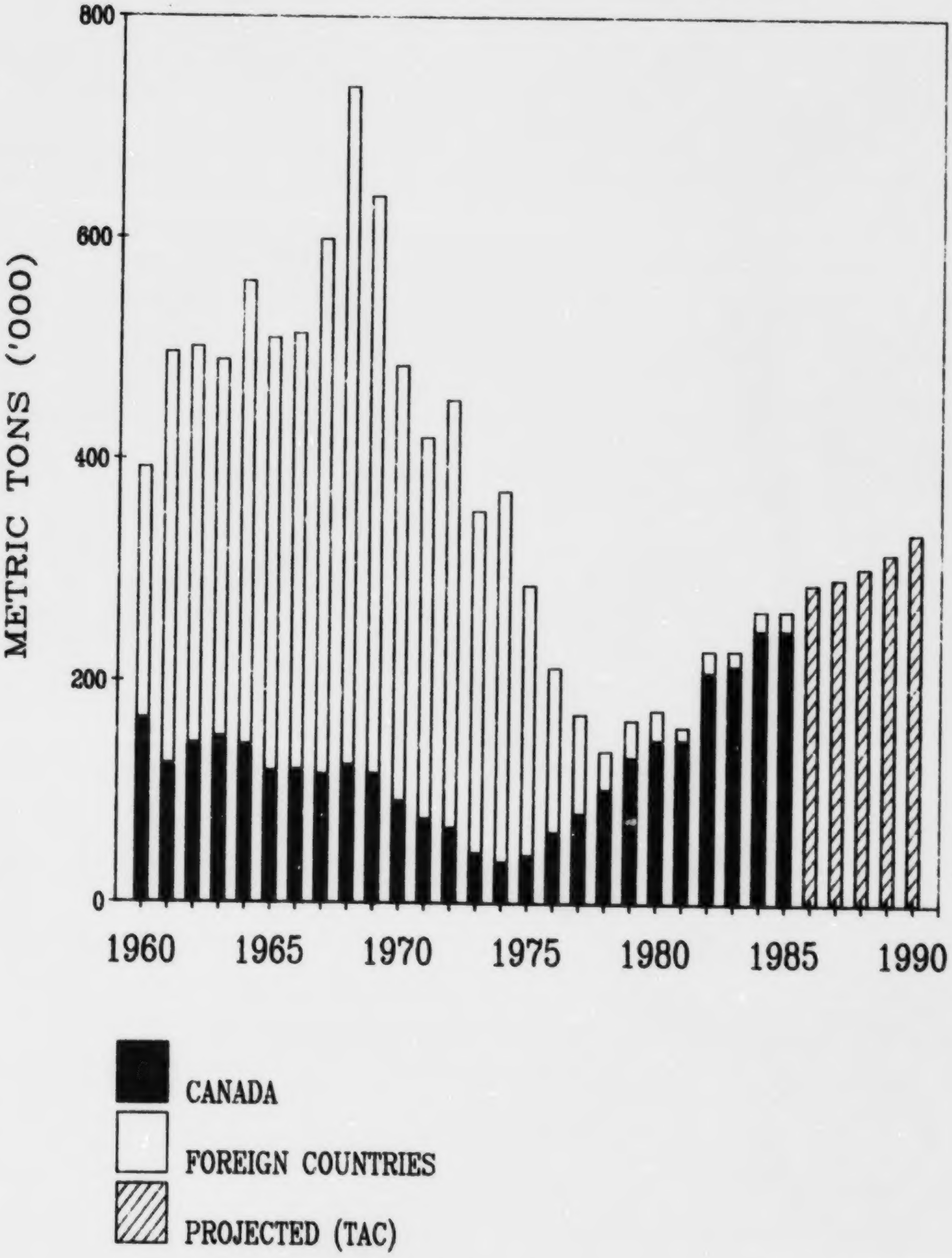


Figure 30

COD, Southern Grand Banks (3NO)

Landings for 1960–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.

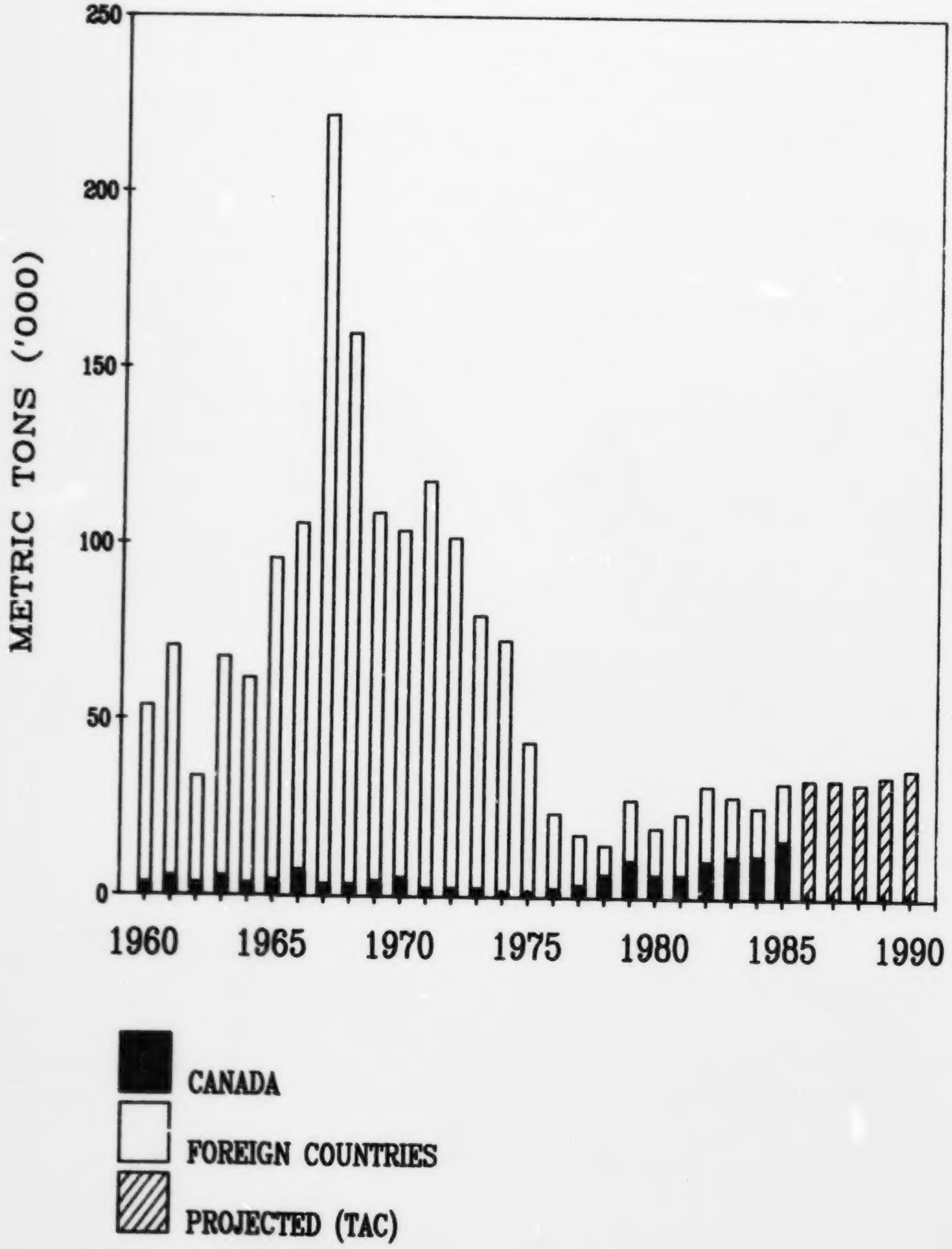


Figure 31

COD, North and East Gulf of St. Lawrence (4RS-3Pn)

Landings for 1960-1983, TAC for 1984 and 1985,
and projected TAC for 1986-1990.
Landings for 1983 are preliminary estimates.

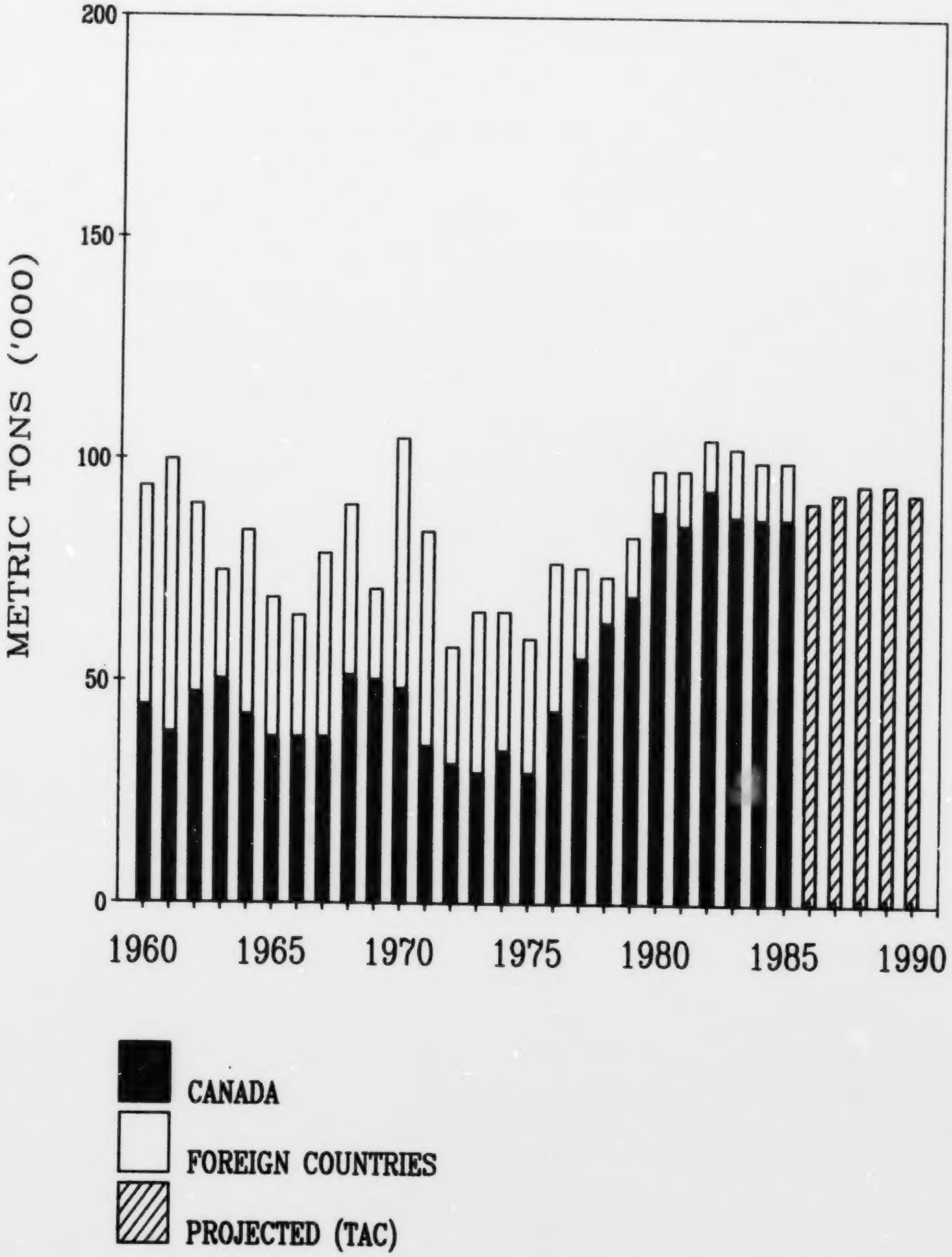


Figure 32

FLATFISH, Grand Banks (3LNO)

Landings for 1969–1983, TAC for 1984 and 1985,
and projected TAC for 1986-1990.
Landings for 1983 are preliminary estimates.

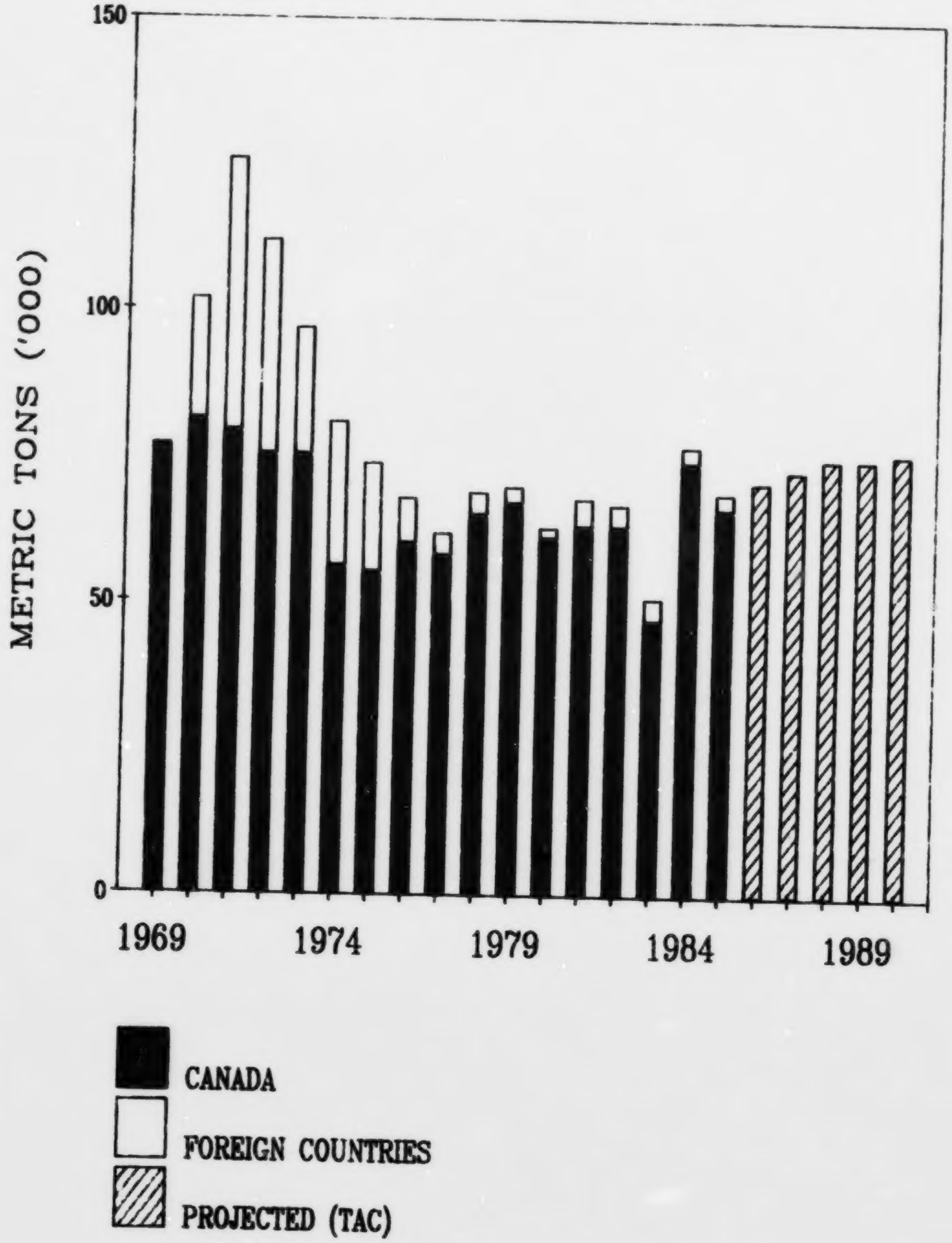


Figure 33

FLATFISH, Scotian Shelf (4VWX)

Landings for 1969–1983, TAC for 1984 and 1985,
and projected TAC for 1986–1990.
Landings for 1983 are preliminary estimates.

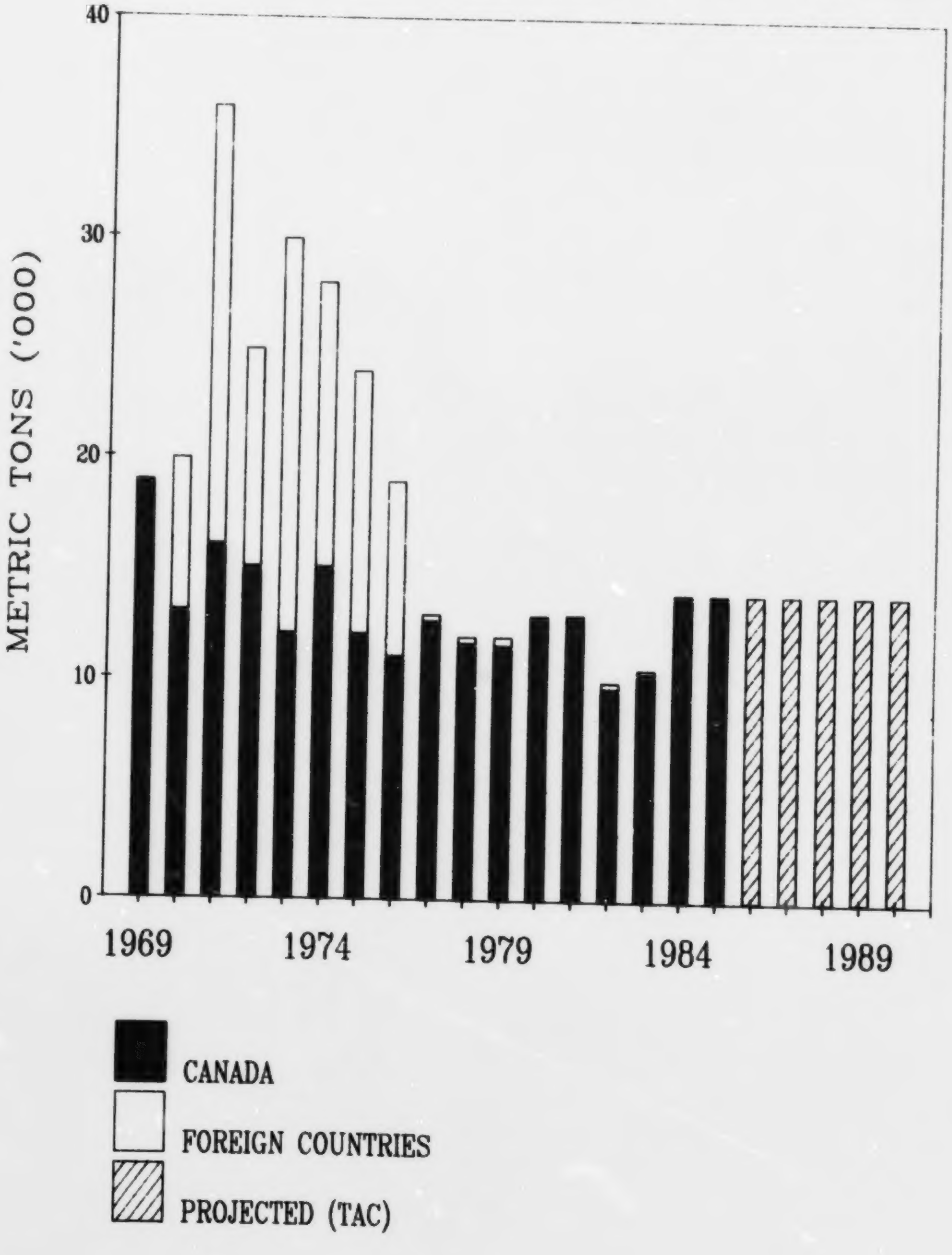


Figure 34

LOBSTER - Newfoundland.

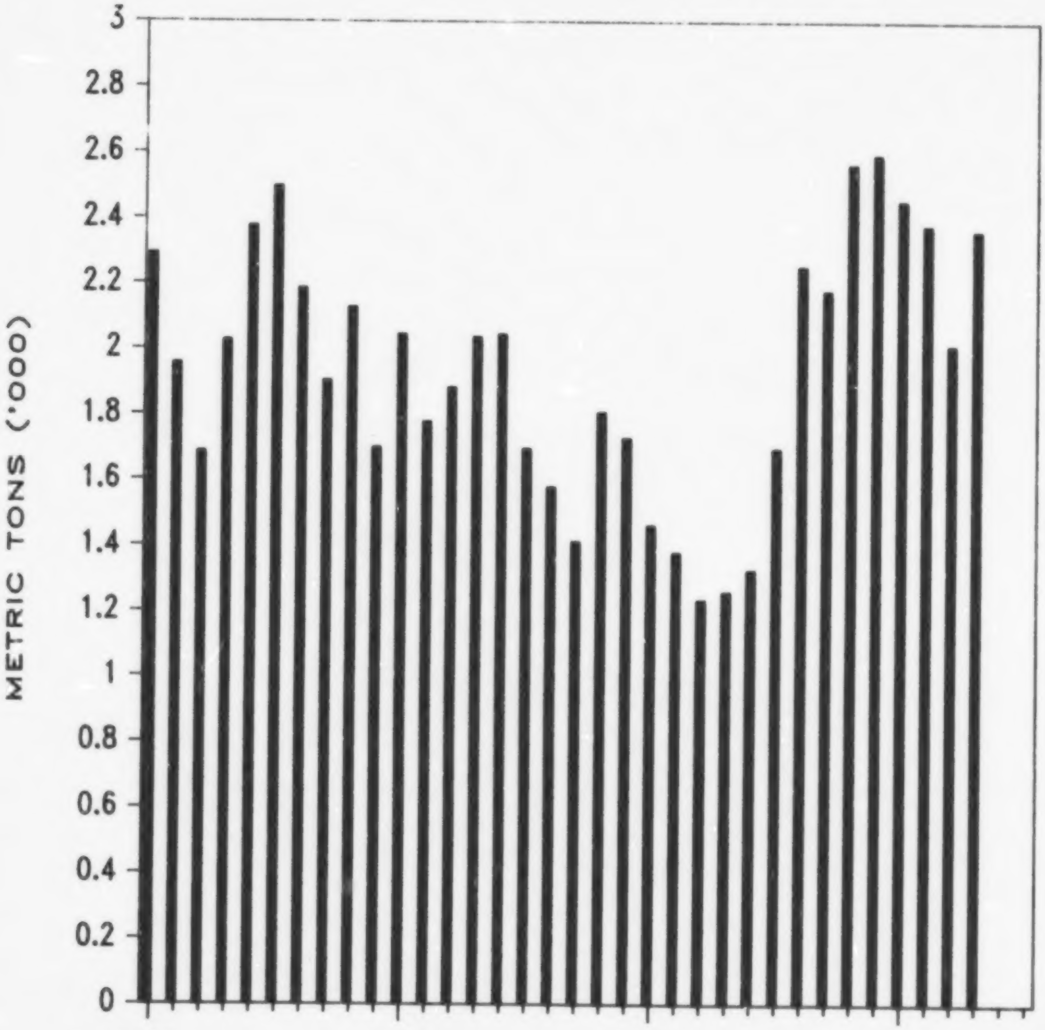
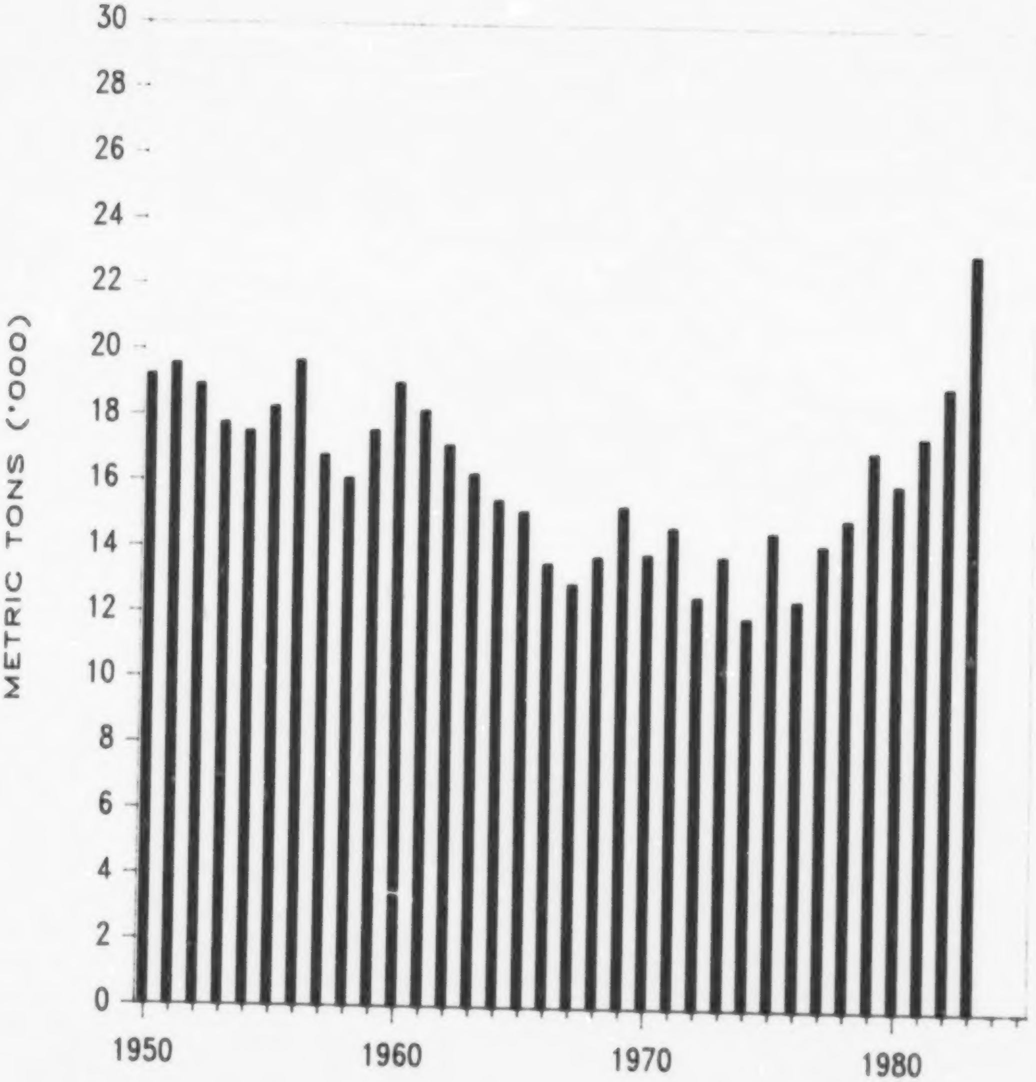


Figure 35



LOBSTER - Maritime Provinces.

Figure 36

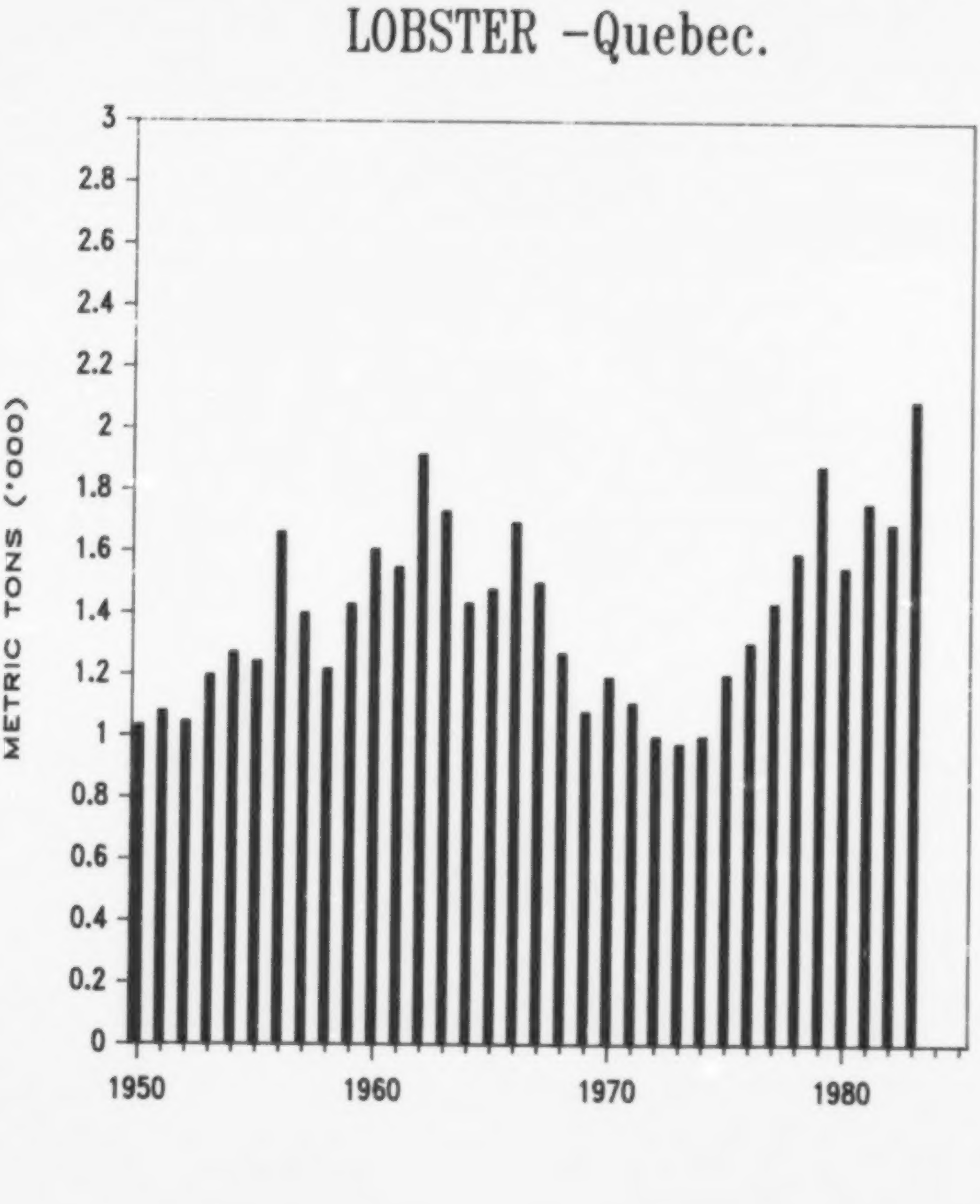

LOBSTER -Quebec.
METRIC TONS ('000)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1950
1960
1970
1980

Figure 37

SCALLOP, Georges Bank

Landings (scallop meats) for 1960–1983.
Landings for 1983 are preliminary estimates.

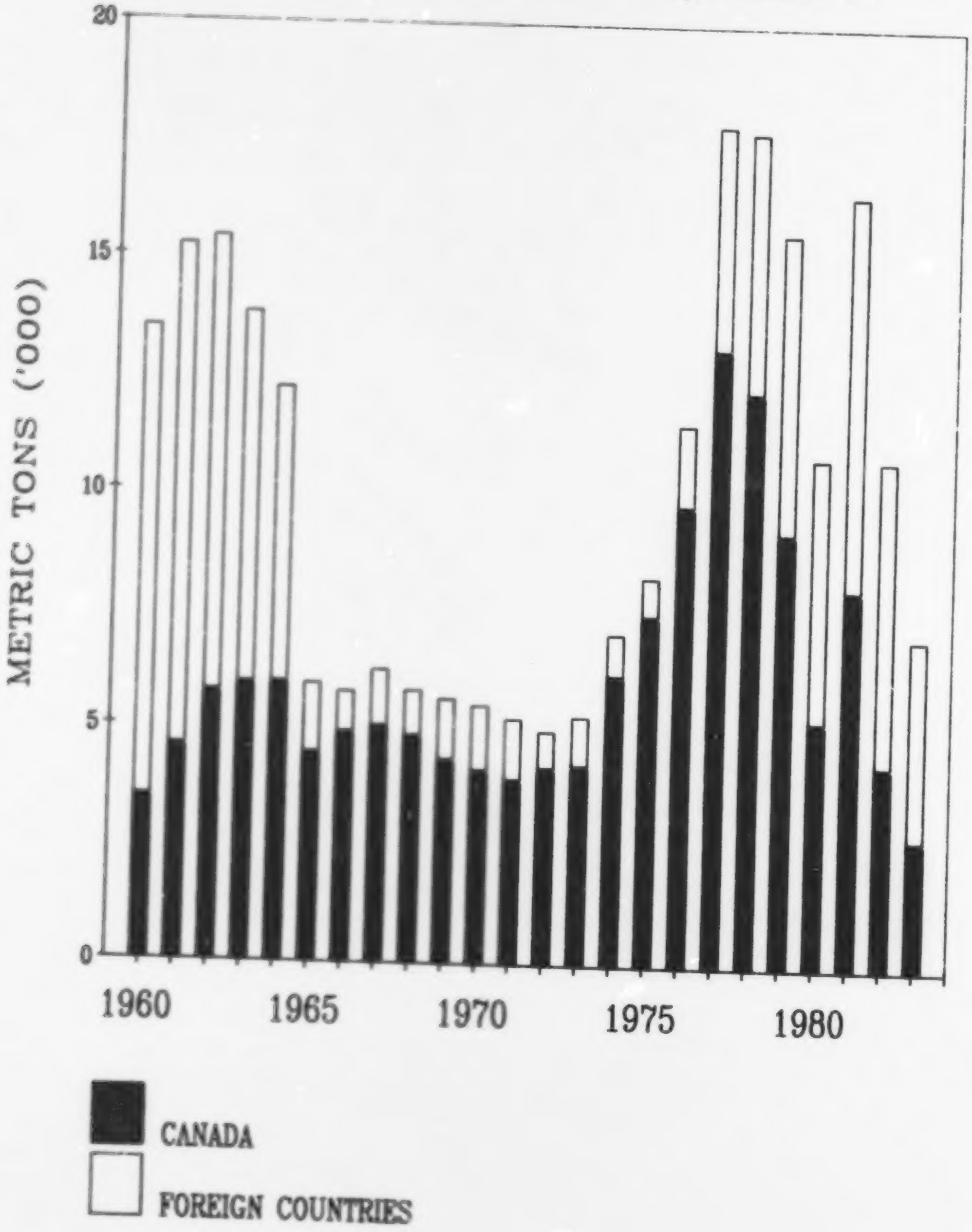


Figure 38

SHRIMP, Gulf of St. Lawrence

Landings for 1965–1983.
Landings for 1983 are preliminary estimates.

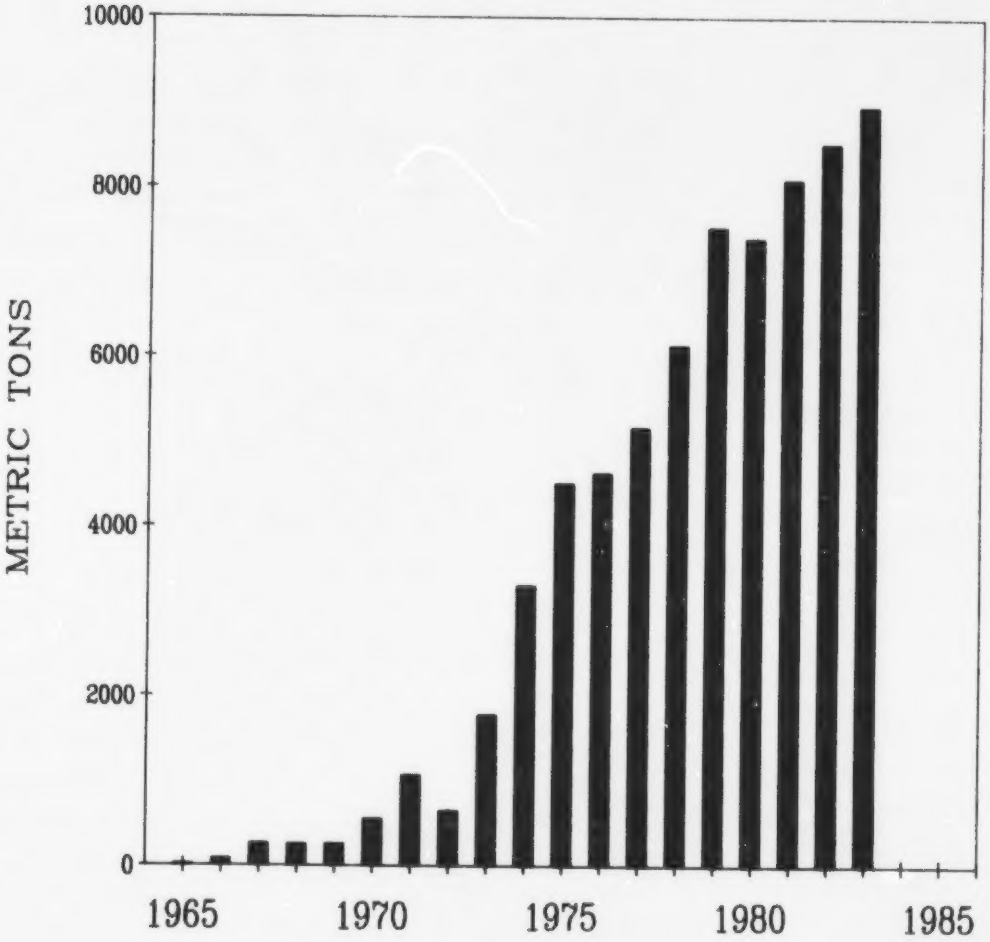


Figure 39

SNOW CRAB

Landings by region for 1975–1984.

Landings for 1983 and 1984 are preliminary estimates.

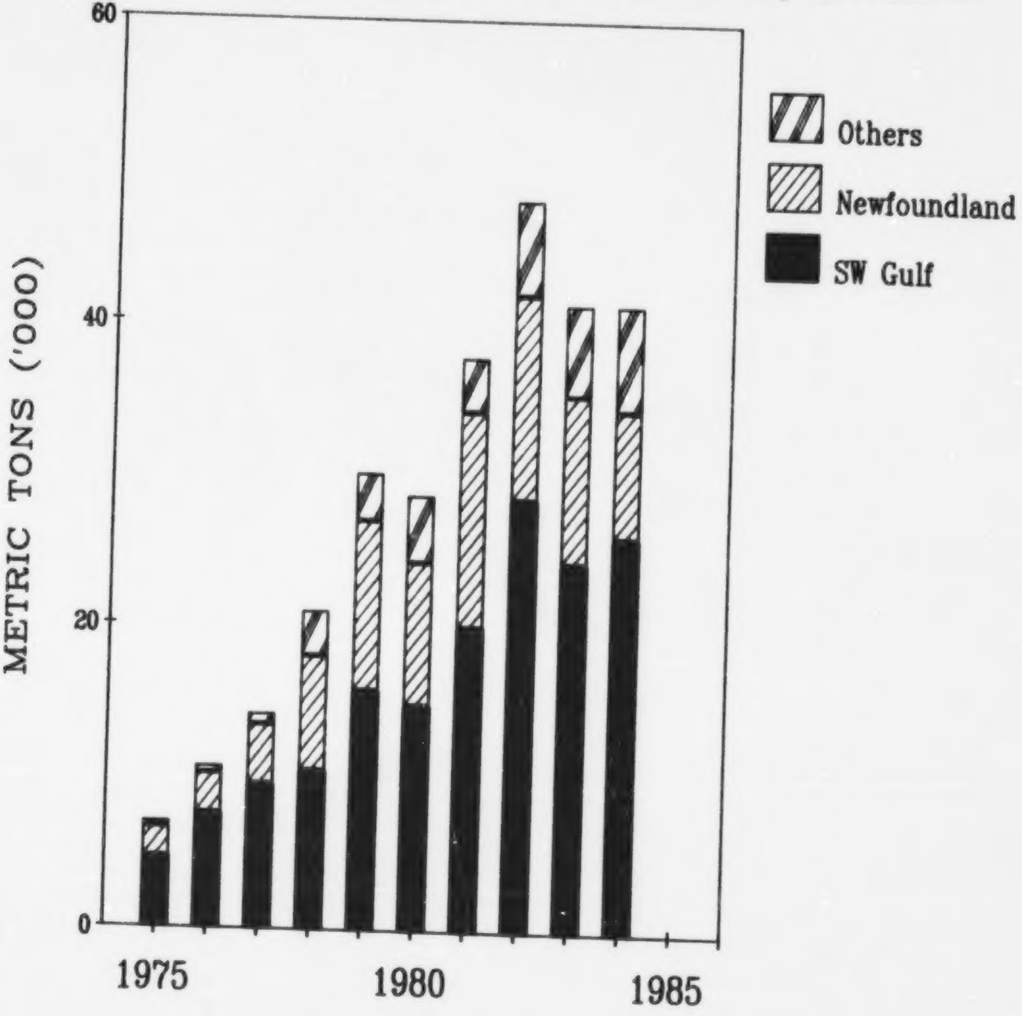


Figure 40